CONSEIL INTERNATIONAL DES UNIONS SCIENTIFIQUES
INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

UNION GÉODÉSIQUE ET GÉOPHYSIQUE INTERNATIONALE
INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

Bulletin of the International Association of Scientific Hydrology

Bulletin de l'Association Internationale d'Hydrologie Scientifique

N° 18

JUIN 1960
JUNE 1960

Abonnement : 150 F b.

Subscription : 150 F b.
for one year

Bulletin paraissant 4 fois par an

Published on behalf of
THE INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY
by
CEUTERICK
153, RUE DE BRUXELLES
LOUVAIN (Belgium)

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LES PROPOS DU SECRETAIRE
REMARKS AND NOTES BY THE SECRETARY

1. Ce numéro paraîtra à la veille de notre Assemblée Générale. Le Secrétaire qui avait beaucoup de choses à vous dire et à vous répéter, les a réservées pour son rapport moral et financier. Les Propos habituels seront donc limités. Vous ne vous étonnerez pas non plus qu'une bonne partie de ce bulletin soit consacrée à la preparation de l'Assemblée et vous y trouverez notamment son programme.

2. Mais vous y trouverez aussi le texte de l'Adresse présidentielle de M. Wilm. Il vous y dit un certain nombre de choses auxquelles je vous demande de bien refléchir.

3. Il sera question du Bulletin à Helsinki. Des promesses et des marques effectives de soutien vous seront demandées. Ce bulletin a surtout joué jusqu'à présent un rôle d'informateur; il doit faire mieux, il doit continuer le rôle scientifique des Assemblées et des Colloques. Il doit surtout assurer la continuité de l'existence entre nos réunions, continuité que le Secrétaire n'estime pas suffisante.

4. Le Secrétaire aurait à vous présenter des Comptes-Rendus du Colloque de Nairobi (O.M.M. - Munitalp) sur la Météorologie et l'Hydrométéorologie Tropicales. Bien que ce colloque ait été tenu en novembre-décembre dernier, l'abondance des matières nous force à vous demander de le remettre au prochain numéro.

De même, le Colloque du Comité de la Zone Aride de l'Unesco à Paris, en mai dernier, vaut la peine qu'on s'y arrête. Pour la même raison, il sera reporté au prochain bulletin.

1. This issue will appear on the eve of our General Assembly. The Secretary who had many things to say or repeat to you has reserved them for his general and financial report. These remarks and notes are therefore briefer than usual. You will not be surprised that a large part of this Bulletin is devoted to arrangements for the Assembly and in particular you will note the programme.

2. You will however find there also the text of Mr. Wilm's presidential address. He tells you there a number of things to which I would ask you to give much thought.

3. The question of the Bulletin will be raised at Helsinki. Promises and effective signs of support will be asked of you. Up to the present the function of the Bulletin has been mainly the reporting of news. It ought to do better than that, it ought to prosecute the scientific advances made at Assemblies and Symposia and above all ensure the continuous vitality of our Association in between gatherings, a continuity which the Secretary does not now regard as sufficient.

4. The Secretary should have included in this issue an account of the Nairobi Symposium (W.M.O.-Munitalp) on Tropical Meteorology and Hydrometeorology. Although this took place in November-December last, the wealth of details of it obliges us to be allowed to defer its publication to the next issue.

Equally, the Unesco Arid zones Committee's symposium in Paris in May last deserves to receive careful attention, so for the same reason it will be reported in the next issue.

5. Un compte-rendu vous sera cependant présenté dans ce bulletin : c'est celui d'une bruchure publiée par le Centre de Développement des Ressources en Eau (Nations Unies) qui présente son rapport sur la période comprenant les deux dernières années.

6. Parmi les publications scientifiques de ce Bulletin, l'attention est attirée sur une étude relative aux cartes hydrogéologiques du Maroc. Cette étude peut-être considérée comme une des premières pierres de l'édifice que nous espérons constituer à Helsinki.

7. Une autre étude de MM. Gherardelli et Canali apporte la participation italienne à notre grande enquête sur les quantités de substances dissoutes apportées à la mer par les cours d'eau. C'est la seule étude de ce genre présentée à Helsinki en dehors de la grande étude de MM. Durum et consorts. Son arrivée un peu tardive ne nous a pas permis de la publier dans le tome consacré aux eaux de surface.

5. An account will however be given in this present issue of a publication of the Water Resources Development Centre (United Nations) which contains its report for the period of the last couple of years.

6. Amongst the scientific articles in this Bulletin is one to which attention is invited a study of the hydrogeological maps of Morocco. The work can perhaps be regarded as one of the stones in the edifice that we hope to build at Helsinki.

7. Another article, by Mr. Gherardelli & Mr. Canali, manifests the part that Italy is taking in our investigation of the quantities of disolved substances conveyed to the ocean by rivers. It is the only study of this kind which will be discussed at Helsinki, apart from the main report presented by Mr Durum and his associates. The slightly belated arrival of the article has prevented us from publishing it in the surface-water volume prepared for the Assembly.

a) ADRESSE PRESIDENTIELLE
PRESIDENTIAL ADDRES

The International Association of Scientific Hydrology: A Dynamic Organization

H.G. WILM [1]

We have a wonderful program ahead of us during the coming two weeks, with an abundance of scientific papers on hydrology which will take up all the time we can devote to them and to their discussions. Therefore I intend that this Presidential address shall be comparatively short, and focused particularly on the activities of the International Association of Scientific Hydrology and on its prospects for the immediate future.

Before going into these subjects, let me say that I have taken a great deal of pride in having been granted the honor of being President of the International Association during the past three years. My only real regret has been that the growing responsibilities of my appointments in the United States have prevented me from doing justice to this high office, and from encouraging to the greatest possible extent the growth and dynamic development of our activities in the Association. Offsetting this regret is my gratitude at the wonderful continuity which has been provided by our highly competent, friendly, and devoted General Secretary, Professor Tison. With the able and friendly assistance of his whole family, Professor Tison has supplied strength and leadership, as well as continuity of work, which have certainly been the key to the constantly increasing success and power of our organization in the realm of science.

These have been exceptionally rich years, since I came to Office after the General Assembly in Toronto 1957. One striking feature has been the growth of the activities of the International Association of Hydrology. Another has been the continuous development and maturing of our Bulletin, under the capable leadership of Professor Tison. Perhaps even more significant has been the organization, planning, and conduct of several yearly symposia, again under the leadership of Professor Tison.

The first two were the extremely successful seminars on ground-water at Dijon, France, commemorating the famous scientist Monsieur Darcy and his establishment of the principles of ground-water science; and the equally successful symposium on glacier movement held in Chamonix, France, in 1958. In spite of my personal interest in both of these subjects, I was unable to attend myself, and greatly regretted this unfortunate circumstance. It was possible, however, for me to attend the fine Symposium on Forests, Water, and Lysimeters at Hannoversch-Muenden, Germany, in September 1959.

To us in the United States, the symposium in Germany marked a particular landmark in the development of watershed management. Near the end of the nineteenth and during the early twentieth centuries, we in America were groping for understanding of the relationships of forests to water supply, floods, and erosion. In this groping process, we reached toward the knowledge gained in Europe : several of our foresters went to Europe for training; and we asked others of your people to come to the United States to guide us in the development of forest management policies, with particular respect to the problems of water supply and floods. During the intervening years, our research people in the United States — with particular leadership by the Forest Service of the Department of Agriculture — have done a great deal in the way of research on the problems of watershed management on forested lands. Therefore

[1] Presidential address, presented at the XII General Assembly of the International Association of Geodesy and Geophysics, Helsinki, Finland, 1960.

it gave us great gratification to be able to attend the Symposium on Forests and Water a Hannoversch-Muenden, and to be able to participate actively in the contributions t knowledge on this important field of hydrology. In addition to the meetings, of course, it wa a great privilege for all of us to visit that lovely city, and to take part in the well-organize field trips from Hannoversch-Muenden into the surrounding region.

These symposia, their successful conduct and the series of good papers presented, and th attendance of scientists which they attracted indicate clearly general strength of our Association under the wise and devoted leadership of Professor Tison. We intend to have this kind c progress continue. There are proposed, for example, symposia in 1961 and 1962: the first one on Ground-water Hydrology; the other, on Land Erosion. These are fine mechanisms fo fostering international communication on scientific progress, and for strengthening the rol of our Association in hydrology on a world-wide basis. As an Association and through th officers, we should certainly exert all possible strength toward the continuation of suc symposia in future years, so as to build up international relationships in scientific hydrology These symposia provide one of the best mechanisms for enhancing the growth of inter national cooperation in hydrology, which is certainly of extreme importance during this era c general international cooperation and better understanding among the peoples of the worl

Recently there has developed some interest and activity directed toward the establishmen of an independent international association of glaciology, in contrast to the work in glaciolog which is now part of our International Association of Hydrology. At this time I can onl express the reaction of the Section of Hydrology of the American Geophysical Union an my own feelings regarding this activity. As far as the American Geophysical Union is concerned the glaciologists prefer to remain affiliated with the Section of Hydrology. From the internationa viewpoint, it seems to me that this would also be the wise decision. We retain and increase ou strength by maintaining a closely coordinated, coherent organization of all scientists who ar interested in the behavior of water — vapor, liquid, and solid — as it moves on and within th earth. Therefore I sincerely hope that glaciologists on an international basis will continue thei allegiance to the International Association of Scientific Hydrology.

Now, what are the major problems that lie ahead of us during the next few years, in th fields of scientific hydrology? In the broadest senses of all, I suppose we could say that thes problems lie in the various kinds of competition for land use. On one hand, there exists a perennial conflict between land use and soil erosion. Only in completely undisturbed condition can land be considered to exhibit «natural erosion». Under some cirumstances, such as th development of improved pastures, erosion may be reduced by human occupancy of land In almost all other cases, however, the use of land by human beings implies the reduction o vegetation through timber cutting, cultivation, or grazing, so that erosion is inevitably increased In some cases, then, the question arises whether the benefits from the land use are equal to o greater than the damages from erosion, siltation of rivers, and the deposits of sediment in reservoirs.

A closely related kind of competition is represented by the frequent conflict between lan use and water supply. When water supplies are abundant, such conflicts naturally do not exis — or exist only to a minor degree. As soon as water becomes at all short, however, then the question arises whether water should be used for irrigation, for the supply of water to domestic industrial, and city demands, or whether it is needed for water power or recreation, or for the dilution of polluting materials in the rivers. Problems like these seem to be almost world-wide in their scope, and become increasingly important as the competing demands for water become more intense.

In any society, the solution to this extremely complicated set of problems lies in the natural interplay and balancing of social, biological, physical, and economic forces. Of these probably the most difficult to handle are the social forces, because they require the intelligent judgment of the people who are most involved in the problems of water supply, flood control land use, and erosion. To provide such intelligent judgment these people need to be informed especially on the physical and biological forces involved in the competitions of land use, erosion,

and water. And this is where hydrologists must play a much more important role than they have up to now. Ordinarily we professional people tend to think in purely scientific terms, reasoning and measuring empirically the physical and biological forces that are involved in hydrologic phenomena. But even when we have worked out the solutions to these problems, we have only begun to solve the far larger problems that are tied up with people. Therefore it is exceptionally important for us to take more active part in the education of the people all over the world who use land and water for their own purposes. This means that hydrologists will have to be thinking more as active members of a dynamic social community, within which the physical and biological influences of hydrology are only a part of the larger social picture which eventually determines the behavoir and condition of water and soil.

Thinking more specifically and a little less philosophically, I suppose the largest problem that faces us has to do with water supply for the people of the world. Everywhere we look we can see the growth of water shortages, in terms of either total supply or usable water. The arid zones of the world, have, of course, been traditionally plagued by water shortages. In many places, the need for water has long ago determined the limitations on the growth of civilization, and has even led to wars among the tribes or nations. But nowadays the growth of water shortages has spread into more humid areas, wherever the pressure of growing populations has meant that increasing numbers of people have outstripped the development of available supplies. This is even true in my rather humid area of New York State, in which total precipitation and steamflow seem adequate for a long time to come; but where excessive concentrations of people in the larger urban areas such as New York City, Syracuse, or Binghamton, and the typical prevalence of low streamflow during the late summer and early autumn mean the continuing increase of water problems.

There are several routes by which these problems may be attacked. Perhaps it would be well to discuss them separately for the areas which should nominally have sufficient or almost sufficient total supplies of water; and for those which obviously have inadequate total supplies at present.

The areas with sufficient or almost sufficient total supplies generally include the «super-humid», humid, and sub-humid zones — except where concentrations of population, as in large cities, produce an unusually intense demand for water. The time-honored and still principal solution for problems of these areas lies in the storage of water, for its transposition from a time of abundant supply (as in the spring freshets) to one of inadequate supply (as in late-summer and early autumn); and from place to place — as from an area of low population concentration in the mountains, to another of high population concentration. For humid and sub-humid areas, a second major attack on water-supply problems lies through the management of watershed areas, to increase yields. In world areas such as these, the primary motivation of watershed management is to increase the total supply of water; in many areas, this may be supplemented by management to increase the supplies of *usable* water, through the control of siltation and pollution.During the past generation, a great deal of research has been done to find out how total supplies of water can be increased by watershed management, particularly in forested catchment areas. As a result of this research, conducted to a great extent in the United States of America, international attention is becoming focused on the possibilities of manipulating the forest cover of catchment basins in order to decrease evapo-transpiration losses and to make more water available for the needs of civilization. Presentation of the results of research in this field of science was one of the principal aims of the Symposium at Hannoversch-Meunden last year.

But different and certainly more acute are the problems of areas that have inadequate supplies of water either today, or in the near future. These are not only the arid zones of the world, but those in which the increasing density of human population places unusual demands on water supplies. In such world areas, watershed management provides promising outlooks for the future. In relatively humid zones where populations are dense, the management of watershed vegetation may offer real promise for increasing yields of water per unit-area of land to a degree sufficient to meet expanding needs for some time to come. In the more arid zones, where the

total yields of water are rather small and the influences of vegetation on total yields are correspondingly small, the prospect of watershed management to increase total supplies may not be so promising. On the other hand, the management of watersheds to increase *usable* water may still be very valuable. Such management would be aimed first, of course, at the storage of available supply; but only with slightly less importance at the preservation of water quality through decreasing erosion of watershed land surfaces, and therefore the siltation of streamsand reservoirs.

For both humid areas of high population and more arid zones of the world, desalination may in the future offer real prospects for increasing available water supplies — especially if and when the use of atomic energy makes these processes more nearly within the economic reach of human populations. At present the cost of converting saline water to solutions with a small enough concentration of salts to be usable for irrigation, domestic and industrial use is comparatively high. The continuous reduction of conversion costs means, however, that even now de-salinized water is within the reach of industry and some domestic uses as long as the converted water is quite close to the source — saline sea, or ground-water. It may be quite possible that further reductions in cost may put this kind of water within the reach of irrigation close to ocean coasts, or of domestic and industrial uses at distances more greatly removed from the coast. It must always be remembered, however, that the present cost of fresh-water supplies is essentially zero where the water is first picked up (as at the bottom of a well, or in a river). Thus the only cost to the user is the cost of developing distribution systems: reservoirs, pipelines, and pumps designed to move the water from its fresh-water source to the place of use. It must therefore be obvious that the cost of water converted from saline conditions can come into competition with fresh-water sources *only* when the cost of transportation of fresh water from its source to the point of use becomes greater than the cost of conversion and transportation of salt water. This simply means that for a long time to come, converted saline water will be available for human use only close to the sources.

Of course the potential use of atomic energy creates a great unknown in prospects for the future of water supplies. If it is possible to devote atomic energy very cheaply to the conversion of saline water to fresh, or to the transportation of water of any kind from its source to the point of use, then the whole relationship of sources, transportation, and costs may be changed. As yet, however, one can only say that this is an unknown proposition, for which the future is optimistic but to some degree unpredictable.

Tied in with the quantity, distribution, and quality of water supplies — but on the whole secondary — are the questions of flood control, water power, and soil stabilization. It has already been suggested that watershed management for the production of maximum yields of *usable* water is tied very tightly into the questions of soil stabilization and sediment control in streams. This simply means that, in humid, sub-humid, and arid zones alike, the protection of the watershed surface from erosion and sedimentation is necessarily an important phase of watershed management — whether this management is aimed at production of total supplies of water or of maximum yields of usable water. Aside from the regulation of streams which is induced by good land management, of course the use of reservoirs for flood control is tied to some extent into their use for water-supply regulation. Similarly, reservoirs may be used for the development of water power as well as for storage of water for human needs and for flood control. It is a long-established truism, however that it is not easy to combine the uses of storage reservoirs for flood-control, irrigation, water supply, and power, and recreation without sometimes creating impossible conflicts in demand. Only in the largest and most expensive dams and reservoirs does it seem possible to combine all of these otherwise conflicting needs. For smaller reservoirs, flood control obviously requires that the reservoir storage be kept as low as possible in anticipation of an unexpected flood; irrigation requires maximum storage early in the year, with progressive release of water through the seasons when crop development demands maximum supply; water power calls for maintaining a «head» above the power plant and a regulated storage of water in the reservoir enough to provide maximum amounts of «firm» electric power to the consumers; and recreation demands comparatively uniform levels of water on a year-around basis. In many areas, therefore, it becomes an

nportant social and political issue as to which of these various demands for water are most nportant, and which should be subordinated to the dominant demand.

Incidental to these problems of water supply, runoff, land use, and erosion, but also tremendously important is the question of how much earth material is actually being transported by ne rivers into the sea. This question is being attacked by the International Association of ydrology through a scientific investigation that is extremely broad in scope and world-wide application.

As commented by Mr. Walton H. Durum of the United States Geological Survey in escribing this international project: «Inherently, the organizational structure and international ordination that is possible enables us to conduct successfully such studies as the current rogram, «World-wide runoff of dissolved solids». The Committee appointed at Toronto by rmer President J.T. Thijsse, is coordinating with scientists in about 30 countries to obtain ydrologic data on the 65 to 70 principal rivers of the world.

«It is gratifying to learn of progress in the study to the point that preliminary computations ave been made of chemical losses to the oceans from North America and from all the territory f the USSR.

«Evaluation of results continues for about 45 of the streams for which data have been obained to date. The objectives of the study have been met in North America, in most parts of urope Central and Southeastern Asia, and parts of South America. However, progress has been ow in obtaining data for most rivers of Africa, parts of South America, and all of China.

«Among the informative data developing from the study is the high rate of chemical sses from humid areas in contrast to semi-arid to arid areas of a continent, and the relationship f the dissolved solids concentration and composition to runoff per unit of drainage area.

«In addition to the determination of principal ions, new and meaningful quantitative sults for about 25 dissolved minor elements have been obtained by the use of sensitive spectroraphic techniques. Of particular importance are the elements boron,barium, strontium, romium, copper, nickel, lead, and titanium which occur in most waters in microgram uantities».

Here is an extremely important example of the projects in hydrology that are being undernken by the International Association, and that will help inform us on the dynamic changes ere are occurring in our world as a result of the movement of water over and within the rface of the earth.

In conclusion, I should like simply to say that water is and will long be the limiting factor r the development of civilization on a world-wide basis. This is, of course, especially true those zones of the world that have small total precipitation and water yield; but it is becoming ore and more important even in the wetter areas of the world. Therefore it seems obvious at the science of hydrology and the people who practice this profession must necessarily ay an increasing role in the further development of civilization. Thus I am convinced that the ternational Association of Scientific Hydrology can look forward to increasing strength nd to a great and dynamic future. Again I regret that my own contribution to the growth f our Association could not have been greater during the past three years and regret especially e need for stepping out of the Presidency during this period of great and progressive activity. t the same time, I am delighted to pass on to more competent hands the tasks that lie before us the immediate future; and I know that, whoever my successor will be, the Association can ok forward to continued strength, growth, and continuity of activity under the wise guidance f our officers and of our General Secretary.

Now, please accept my very best wishes for successful meetings here in Helsinki; I am oking forward with the greatest of pleasure to participating in them with you.

b) RAPPORT DU SECRETAIRE SUR LA VIE DE L'ASSOCIATION AU COURS DE LA PERIODE 1957-1960

1. Les secrétaires ont parfois l'habitude de gonfler leur rapport de façon à faire croi à une activité considérable. Je ne sais si je suis moi-même tombé dans ce travers, mais m'aperçois une fois de plus, que j'ai beaucoup de choses à vous dire. Il est vrai, comme vous le disais déjà à Toronto, que cela provient sans doute aussi du fait, qu'avec l'âge, devient plus bavard. Vous allez pouvoir en juger.

2. Et comme d'habitude, le premier de mes soucis est resté la situation financière. tableau suivant vous donne le relevé de nos dépenses et de nos rentrées au cours de la péric qui nous intéresse.

I.A.S.H. Abstract of accounts for the period : 1 Jan. 1957 - 31 Dec. 1959

1. Amounts in $ Exchange rates	IUGG	Grants & Contract
RECEIPTS		
2. IUGG Allocation	14.110	
3. UNESCO grants		
4. Organizational expenses		
5. Publications		1.250
6. Meeting of committees		—
7. Symposia		3.000
8. Permanent Services		—
9. Other grants		1.000
10. Contracts		—
11. Sales of publications	18.920	
12. Mischellaneous	50	
13. Total receipts	33.080	5.250
EXPENDITURES		
14. Secretariat		
15. Personnel	620	
16. Quarters (rent, light, heat, etc.)	—	
17. Supplies and equipment	130	
18. Postage, telegrams, telephone	990	
19. Travel (except for assemblies and symposia	180	
20. Miscellaneous	260	
21. Publications		
22. C.R. Assemblies	14.660	2.250
23. C.R. Symposia	10.300	1.250
24. Periodicals	3.820	—
25. Others	—	—

5. Assembly		
7. Organization	—	—
8. Travel	180	—
9. Symposia		
0. Organization	50	—
1. Travel	70	1.750
2. Scientific meetings		
3. Subventions to Permanent services, etc.		
4. Contracts		
5. Miscellaneous		
6. Total expenditures	31.260	5.250
7. Balance on hand 1 jan. 1957	140	0
8. Total receipts	33.080	5.250
9. Accounts receivable		
0. Total	33.220	5.250
1. Total expenditures	31.260	5.250
2. Accounts payable	1.880 *	
3. Balance in hand 31 dec. 1959	80	
4. Total	33.220	5.250

Il résulte de ce tableau divers points sur lesquels je me permettrai de m'arrêter quelques nstants.

a) Nous avons commencé la periode avec un avoir quasi nul et nous la finissons de la ême façon, car notre avoir au 31-12-59 ne consiste en fait que dans l'avance pour 1960 que ous a faite M. Laclavère.

b) Constatation plus réconfortante : nos ventes qui furent de 2.000 dollars de 1951 à 954 et de 6.085 dollars de 1954 à 1957, passent à 18.920 dollars de 1957 à 1960!

c) Sur un total de dépenses de 36.510 dollars, nous voyons que l'impression de nos ublications intervient pour 32.280 dollars, soit près de 90%. Pour la période précédente, ous avions consacré à nos publications environ 22.000 dollars. Je ne crois pas que l'accrois- ement de cette dépense doive nous effrayer, mais il doit cependant exiger une certaine vigilance. 'et accroissement est la suite logique du développement de notre activité. En effet, les omptes-rendus et Rapports de Toronto ont coûte de l'ordre de 17.000 dollars, à peu près omme ceux de Rome. Ce qui a fait monter la dépense, c'est qu'au lieu du seul colloque Darcy ntre 1954 et 1957, nous avons eu ceux de Chamonix et de Hannoversch-Münden entre 1957 t 1960. D'autre part, les rapports du Colloque Darcy n'ont été que partiellement payés au ours de la période précédente, si bien qu'une partie de la dépense a dû être liquidée au cours de a période qui vient de finir. C'est ce qui explique que l'impression des communications aux olloques, qui n'avait coûté que 3.500 dollars au cours de la période précédente, intervient our 11.500 dollars dans la période sous revue.

d) Si on compare les deux périodes 1954-1957 et 1957-1960, on s'aperçoit qu'au cours e la première de ces périodes, nous avions dépensé en plus de nos rentrées, notre réserve de 954, soit 4.750 dollars et que, de plus, nous n'avions payé que partiellement l'impression du olloque Darcy. Durant la deuxième période en visagée, c'est-à-dire durant celle qui est en fait

(*) Mr. Laclavere PAID IN 1959 A PART (1.880 S) OF THE U.G.G.I. SUBVENTION FOR 960.

sous revue, nous n'avions plus de réserve à dépenser, nous avons payé nos dettes et en dép
de l'organisation de deux symposia, nous clôturons l'exercice sans dettes.

Nous avons donc lieu d'être très satisfaits, tout en nous promettant d'être très vigilan
et de faire un effort pour que la situation ne se détériore pas. A ce sujet, j'estime en effet que
maintien du chiffre de nos ventes va maintenant exiger un effort continu : c'est ainsi que l
premiers mois de 1960 semblent indiquer une décroissance qu'il faut arrêter à tout prix.

e) Le secrétaire voudrait attirer l'attention une fois de plus sur la quasi impossibili
de maintenir les frais généraux du secrétariat à leur montant actuel 1.640 dollars soit un p
plus de 4% de nos dépenses. C'est la nécessité provoqée par une caisse peu fournie qui no
a forcés à réduire ces dépenses. mais il est impossible de les maintenir à ce taux.

Après l'examen des comptes des années passées, nous arrivons au budget du triennat e
cours. Le tableau suivant vous donne une idée de nos prévisions.

I.A.S.H. Prévisions budgétaires pour la période 1/1/1960-31/12/1962

RECEIPTS		
Allocation U.G.G.I.	18.000 $	
Unesco Grants		
Organizational expenses		
Publication		4.000 $
Symposium		4.000
Other Grants		1.500
Contracts (1)		16.000
Sales of Publication	20.000	
Total Receipts	38.000 $	25.500 $
EXPENDITURES		
Secrétariat		
Personnel	1.600 $	
Supplies Equipment	400	
Postage T.T.	1.500	
Travel (except for Assemblies and Symposia)	700	
Miscellaneous	300	
Publication		
C.R. Assemblies	16.000	4.000 $
C.R. Symposia	10.000	6.000
Periodicals	6.000	
Others (Bibliographies)		1.500
Assembly and symposia in Helsinki 1960		
Organization	300	
Travel		4.000
Symposia		
Organization		1.000
Travel	1.200	9.000
TOTAL EXPENDITURES	38.000 $	25.500 $

(1) Pour 1960 et 1961, j'ai déjà des contracts avec l'UNESCO pour 12.000$

a) On y remarquera que nous avons largement augmenté ce que nous espérons recevoir l'UGGI : 18.000 dollars au lieu de 11.760. Le Comité des Finances de l'Union avait suggéré e nous fassions ces prévisions en tenant compte d'une activité telle que nous la souhaitions.

b) Nous avons aussi augmenté quelque peu le montant espéré de nos ventes. Il vous partient à tous de faire en sorte que mes prévisions soient une sous-estimation.

c) Vous remarquerez aussi que j'ai fait intervenir les contrats pour un montant très élevé : .000 dollars. C'est que déjà à l'heure actuelle, comme je l'exposerai par après, j'ai réussi établir des contrats pour 12.000 dollars pour les seules années 1960 et 1961.

d) Du côté des dépenses, les seules publications interviennent pour 43.500 dollars. Par ntre, les subventions pour assistance aux Assemblée et colloques se montent à 15.900 llars : ce poste a été largement augmenté par suite de la nécessité de multiplier les colloques des appuis que nous recevons dans ce sens. Enfin les frais généraux ont été quelque peu gmentés.

e) Dans l'esemble, le budget total est en augmentation de 70%, ce qui ne sera possible e par une intervention plus massive de l'UGGI. Vous trouverez peut-être que votre secrétaire vient audacieux : n'oubliez cependant pas qu'il s'appuye avant tout sur certaines réalités mme les contrats signés par l'Unesco.

4. Je suppose que vous estimerez avec moi que les dollars ont suffisamment retenus notre tention et qu'il est temps de passer à ce qui devrait être notre occupation à 100% : notre tivité scientifique.

Permettez-moi de commencer par nos publications.

a) Les comptes-rendus et Rapports de Toronto ont paru en 1958 et l'accueil qui leur a fait se réflète particulièrement dans le chiffre des ventes de cette année-là : 7.000 dollars viron. La distribution gratuite ne porte plus que sur 250 exemplaires environ. Nous avons ntinué à éditer nos publications nous-mêmes, ce qui nous a permis de ne pas laisser de plumes tre les mains des maisons d'édition : nous avons eu le plaisir de voir, au cours des derniers ois, que cette façon de procéder recevait des soutiens d'importance. Cette méthode demande ns doute du secrétaire un effort supplémentaire, mais cet effort serait considérablement duit si les auteurs et les représentants nationaux suivaient tous nos indications relatives aux lais, à la présentation des manuscrits, à la confection des figures, etc...

b) D'autre part, nous avons publié en 1958, les rapports présentés au Colloque de Chamox sur la Physique du Mouvement de la Glace et en 1959, ceux des Colloques de Hannoversch-ünden sur «Eau et Régions Boisées» et «Lysimètres». Pour tous ces colloques, les rapports nt été imprimés avant la réunion et bien des participants m'en ont exprimé leur gratitude. uis-je vous avouer que j'ai accepté ces expressions de gratitude car qui dira les difficultés qu'il ut surmonter pour cette réalisation : à Chamonix notamment, les rapports d'un très grand ays me sont arrivés trois semaines avant l'ouverture du colloque. Nous reparlerons du succès ces colloques, mais une des meilleures preuves n'en est -elle pas la demande continue des mes qui en rassemblent les communications, surtout ceux de Hannoversch-Münden.

c) Je voudrais m'étendre quelque peu sur le Bulletin. A Toronto, vous avez bien voulu 'accorder carte blanche pour la continuation de ce bulletin qui à l'époque, semblait difficilement viable. Ce bulletin m'a sans doute imposé quelque travail, car j'en suis à la fois le rédacteur en chef, le rédacteur tout simple, bien souvent son dactylographe, son agence de publicité, correcteur des épreuves et l'expéditeur. Je dois cependant dire que j'ai trouvé en Mr Allard ne co-victime qui s'occupe de la partie anglaise. D'autre part, en Grande-Bretagne et aux tats-Unis, un soutien fondamental m'a été accordé pour la diffusion du bulletin et la recherche s abonnés. Je vous disais que j'ai voulu introduire de la publicité dans ce bulletin, suivant une ggestion qui m'avait été faite. Le résultat n'a pas été bien brillant, mais nous réussirons, ir vous allez m'aider.

D'autre part, nous aurons l'occasion de discuter une proposition américaine de MM. angbein et Léopold. Ceux-ci se sont adressés à tous les membres du Geological Survey et ceux de l'American Géophysical Union pour qu'ils réservent certaines de leur publications notre bulletin. Ils proposent aussi de désigner dans chaque pays un «responsable» chargé

de recruter des abonnés, de rechercher des communications, de s'assurer de leur tenue, voir la possibilité de trouver de la publicité, etc... Je ne saurais assez remercier MM. Langb et Léopold de cette aide qui n'est qu'une expression nouvelle du support qu'ils m'ont toujo apporté.

d) Reste la bibliographie. C'est celle de nos publications qui, à l'heure actuelle cause moins de tracas au Secrétaire. On a parfois émis des doutes sur sa nécessité.: la reponse à doutes a été donnée par l'élargissement du cercle des nations qui y participent. 31 natic nous envoient maintenant leur bibliographie et si la regularité de parution n'est pas absol il importe de signaler la rapidité et le soin avec lesquels la Pologne, l'Allemagne, Tchécoslovaquie s'attachent à cette question.

Une remarque générale au sujet de ces publications. Elles sont restées longtemps insuffisa ment connues. Vos efforts et la parution du bulletin qui en donne une liste complète da chacun de ses numéros ont conduit à ce que j'appelle la réussite actuelle. Nous pouvc cependant faire mieux encore, mais il importe pour cela que vous les fassiez mieux connaî encore.

5. Nos relations avec les Organisations Gouvernementales s'occupant de l'eau.

Ce sujet était généralement l'un de ceux que le Secrétaire abordait avec un enthousias réduit, car il estimait que le domaine de l'Association était continûment grignoté par organisations de toutes espèces dont le nombre et les interventions croissaient d'année anée.

Je ne sais si c'est tout simplement une question d'accoutumance, mais il semble cette f au secrétaire qu'il est fort possible, non seulement de vivre en paix avec ces organisatio mais même d'avoir des relations très cordiales et très profitables avec elles.

En première ligne, vient l'Unesco. Nos relations avec cette grande Organisation Gouv nementale avaient jusqu'à présent consisté à solliciter et à obtenir, par l'entremise de l'UG et de l'ICSU, des subventions, surtout pour l'organisation de colloques et pour certai publications. Ces subventions, pour la période 1957-1960 furent de 4.250 dollars pour trois années écoulées. D'autre part, l'Unesco avait mis sur pied, il y a dix ans, un Comité Recherches de la Zone Aride. Dès le début, notre Association participa aux travaux de Comité, comme on peut s'en rendre compte des rapports présentés par le secrétaire dans bulletin et particulièrement celui du nº. 19 où il sera question du dernier colloque du comité Zones Arides en mai 1960 à Paris. Le Secrétaire s'est toujours efforcé de faire représen l'Association aux réunions de ce Comité sans dépenses pour elles : depuis 1957, il a notamm pu la représenter aux réunions de Téhéran (1958), de Madrid (1959) et de Paris (196 L'assistance que nous avons apportée a été appréciée par l'Unesco qui, par deux subventic de 3.000 dollars chacune, nous permet d'organiser deux des colloques de cette Assembl celui des Débits de base et Sécheresses et celui des Cartes des Eaux Souterraines. Je me perm d'attirer l'attention sur le fait que l'Unesco attend cependant de nous que nous lui donnic certaines indications sur la confection des Cartes dont il vient d'être question.

De plus, au cours de son colloque de mai 1960, le Comité des Zones Arides, confirma sa suggestion de Madrid en septembre 1959, a décidé de confier à notre Association en 19 l'organisation d'un autre colloque sur les Eaux souterraines : cette organisation fera l'ob d'un contrat de 6.000 dollars.

b) L'Organisation Metéorologique Mondiale, a continué son action en vue de s'adjoin l'Hydrologie. Son dernier Congrès a cependant limité cette action à l'Hydrométéorolog Votre Secrétaire vous a longuement exposé la position de notre Association dans cette affa relativement compliquée dans de nombreux bulletins. Nous continuons à estimer que si u organisation gouvernementale doit s'occuper d'hydrologie, son action doit s'étendre à t le domaine de celle-ci et non à ce qui n'en constitue qu'une partie très limitée. Il faudrait au que les hydrologues se trouvent dans cette Organisation, sur un pied d'égalité avec les représe tants d'autres disciplines.

En dépit de l'avis de son Congrès, l'O. M. M. s'est attelée à l'étude des problèmes hyd logiques, s'occupant en fait d'une hydrométéorologie très large, s'étendant notamment a

crues et à leur prévision et à de nombreux problèmes des Eaux de Surface. L'O.M.M. a organisé à cet effet une Commission d'Hydrologie dont la présidence vient d'être confiée à M.M. Kohler du Weather Bureau. M. Kohler est l'un des représentants américains les plus compétents de notre Association et nul doute que, sous sa conduite, cette commission de l'O.M.M. ne réalisé un travail des plus heureux tout en gardant avec l'AIHS les contacts les plus utiles et les plus cordiaux. La section européenne de cette commission de l'O.M.M. s'est réunie en 1958 à Varsovie : nous avons assisté à cette Assemblée et en avons rendu compte dans le Bulletin.

Ajoutons enfin que l'O.M.M. a organisé à Nairobi, au Kénia, en novembre dernier, un colloque sur la Météorologie et sur l'hydrométéorologie tropicales. Votre secrétaire y avait été invité à présenter un certain nombre d'études. Il vous présentera un court rapport dans le bulletin 19.

c) Comme nous l'avons également signalé dans un de nos bulletins, les Nations Unies ont d'autre part créé un Centre pour les Water Resources Development. Il est question des travaux de ce Centre, dirigé par le Père de Breuvery, dans le bulletin 18.

d) La F.A.O. s'est particulièrement interessée à notre Colloque de Hannoversch-Münden où elle s'était fait représenter. Elle s'est intéressée avec les autres Organisations Gouvernementales à un dictionnaire des Eaux Souterraines, qui a provoqué une réunion à Rome où nous représentions l'A.I.H.S.

Une autre Organisation Gouvernementale, mais n'appartenant pas aux Nations Unies, l'I.S.O. s'occupe de le standardisation des mesures en rivière par un Sous-Comité de l'ISO 30. Nous n'avons pas pu suivre les travaux de ce Comité d'une façon continue, mais il est cependant bon que nous nous intéressions à son travail.

6. Organisations non gouvernementales.

De nombreuses organisations de ce genre s'occupent de domaines bien proches du nôtre, et qui recouvrent même celui que nous nous croyions réservé.

a) Parmi ces dernières, nous citerons d'abord l'Association Internationale des Hydrogéologues dont le champ d'action, d'après ce qui m'a été confirmé par un de ses dirigeants, est en fait identique à celui de notre Commission des Eaux Souterraines. J'ai eu de nombreux contacts avec ses représentants qui nous ont conviés à participer à leurs travaux, et notamment à leurs réunions de Madrid et de Lille. Cette Association est représentée à notre Assemblée Générale. L'existence de cette Association est défendue par le fait que notre Association étant du type semi-gouvernemental, ses membres en sont les gouvernements ou les corps scientifiques désignés par eux. Les participants à nos réunions sont donc en principe des délégués de gouvernements dont le nombre est forcément limité, certaines personnes étant ainsi exclues. Nous espérons cependant qu'il sera possible de tourner dans une certaine mesure cette difficulté, ce qui permettrait à l'Association en question de rallier la nôtre. Les deux organisations ont d'ailleurs de très nombreux membres communs.

b) Une autre association dont le domaine semblait ne devoir jamais se superposer au nôtre, nous a fait la surprise de mettre à l'ordre du jour de sa dernière réunion, des questions relatives à la glace... Il s'agit de l'Association Internationale de Recherches Hydrauliques. Elle aurait d'ailleurs voulu se limiter à l'aspect technique de ces questions, mais il est bien difficile de délimiter ce qui est technique de ce qui est puremunt scientifique. L'A.I.R.H. est représentée à notre Assemblée.

c) L'Association Internationale des Distributions d'Eau s'occupe aussi de temps en temps de questions qui sont très proches de celles étudiées par notre Commission des Eaux Souterraines.

L'Association Permanente des Congrès de Navigation reste bien dans son domaine technique : elle est aussi représentée ici.

L'Association des Grands Barrages se limite aussi généralement à ses problèmes techniques.

Notre Association a aussi eu des contacts intéressants avec d'autres organisation comm
la Société Hydrotechnique de France, l'Institut Panaméricain, les missions de l'Unesco, etc.

7. L'action Scientifique de l'A.I.H.S.

A certains points de vue, nous avons lieu d'être satisfaits des résultats obtenus. N
publications sont des plus appréciées, les organisations gouvernementales ont confiance
nous. C'est ainsi que, comme nous l'avons déjà dit, l'Unesco vient de nous confier d'essay
de mettre d'accord les multiples présentations des cartes hydrogéologiques et s'associe à no
pour l'organisation de colloques scientifiques.

Les divers colloques que nous avons tenus ont réalisé des assistances et obtenu d
résultats scientifiques hors de proportion avec les faibles moyens dont nous disposions. Not
Bulletin voit s'ouvrir des destinées inespérées. Dijon, pour les Eaux Souterraines et les Crue
Chamonix pour la Glace, Hannoversch-Münden dans le domaine en liaison avec les forestie
d'une part et la Science des Sols d'autre part, constituent des bases dans la recherc
hydrologique.

Et cependant, pour ma part, je ne suis pas complètement satisfait. Les hydrologue
pleins d'enthousiasme à la fin de leurs réunions, le perdent dès qu'ils se séparent. Ils ne perde
pas la foi, mais... la foi sans le oeuvres est une foi morte!

Après les réunions, disais-je déjà à Toronto, il faudrait essayer de dégager de ce qui
été présenté, ce qu'il importerait de retenir, de codifier. Tout ce qui demande un travail co
structif est abandonné. On laisse à d'autres organisations, moins préparées que la nôt
le soin de s'occuper de résoudre des problèmes que nous aurions dû attaquer et fai
avancer depuis longtemps.

Cette cause de faiblesse devrait être examinée. Je n'en exagère pas l'importance, ma
la politique de l'autruche n'est jamais la bonne. Soyez cependant rassurés, je ne suis p
un pessimiste. Je crois, pour ma part, qu'il y aurait peu à ajouter à nos méthodes actuelle
Elles doivent être complétées pour assurer un meilleur contact et un certain travail entre n
réunions.

Je crois que le bulletin pourrait jouer un très grand rôle dans un pareil dessein. Je vo
ai déjà dit un mot à ce sujet : nos amis des Etats Unis ont des idées à ce sujet.

D'un autre côté, il semble bien que la présentation sous la forme Colloque frappe pl
fortement les esprits que celle de nos massives Assemblées que nous pouvons d'ailleurs allég
en y incorporant des Colloques comme nous l'avons fait cette fois. Il faut donc continuer da
cette voie : en 1961; nous aurons le Colloque sur les Eaux souterraines avec l'Unesco; en 196
l'Italie nous offre d'organiser un Colloque sur l'Erosion Continentale. La Commission q
s'occupe de ces problèmes n'a peut-être pas réussi comme les autres. Nous devons l'aider
le colloque envisagé me semble de nature à recatalyser son développement. J'ai vaguem
entendu parler de la possibilité d'un colloque sur un sujet appartenant aux Neiges et Glac
mais je n'ai aucune précision sur ce point. Il avait été question également d'une réunion s
l'évaporation et l'évapotranspiration, mais je suis sans nouvelles du Comité qui s'en occup
Enfin, un de nos amis hongrois attirait mon attention récemment sur les problèmes
l'hydrométrie. Nous avons eu autrefois une commission des Mesures. Elle n'a pas survé
à la guerre et un timide essai de Comité des Instruments lui a succédé. Comme je vous l
dit en passant, d'autres se sont occupés de la matière. Je ne crois pas que nous devo
condamner notre comité des Instruments, mais il faudrait au contraire lui infuser un sa
nouveau.

8. Mais à vous parler de l'avenir, je néglige le présent. L'Assemblée de Helsinki est,
effet l'occasion de quatre colloques qui semblent tous devoir donnèr des résultats excellen
Nous avons pu imprimer les communications rélatives à deux d'entre eux : celui des débits
base et sécheresses et celui des Rivières à Marée. Nous avons été soutenus dans leur préparati
par l'Association de Météorologie et celle d'Océanographie.

Nous attendons beaucoup de notre colloque sur les Cartes des Eaux Souterraines q
est l'occasion d'une exposition specialisée surprenant par son étendue et le rapide développeme

de cette question. Quant au Colloque sur l'Antarctique, imaginé un peu tardivement, grâce à l'aide de M. Robin et du SCAR, il a été possible de rassembler un nombre quasi incroyable de communications.

Tout le bien dit des colloques ne doit cependant pas nous faire perdre de vue le travail des commissions et des comités. Jai reçu une véritable avalanche de communications : je m'en réjouis et cependant..., je m'en inquiéte aussi un peu, car le coût de l'impression n'est pas sans me causer quelques soucis. La Commission des Neiges et des Glaces a particulièrement participé à ce flot : 80 communications (plus de 100 si nous comptons celles sur l'Antarctique). Je dois cependant avouer que ce n'est peut-être pas un record, au moins en volume, car à Edimbourg, en 1936, la masse fut au moins aussi considérable, à l'appel du dynamique professeur Church. Plusieurs glaciologues et notamment M. le Secrétaire Ward m'ont fait part de leurs impressions à ce sujet : ils voudraient voir ordonner quelque peu le travail de cette commission qui pourrait notamment s'imposer un certain nombre de sujets comme le font les autres commissions. Je m'excuse de cette intrusion dans les affaires intérieures d'une commission, mais elle m'a été suggérée par certains de ses membres.

Les Commissions des Eaux de Surface et des Eaux Souterraines ont traité, à côté des colloques dont nous avons dit les promesses, un certain nombre de questions qui, comme celle de la salinité au voisinage des Côtes et des Substances Radioactives, ont donné des résultats assez comparables à ceux des Colloques eux-mêmes. Il vous a été déjà parlé de la Commission de l'Erosion Continentale.

Que dire de nos Comités? Celui des Précipitations et celui de l'Evaporation continuent à donner de bons résultats, mais peut-être pourrait-on leur donner un conseil analogue à celu dont il a été question pour la Commission des Neiges et des Glaces et leur demander de limiteir leur préparation à un certain nombre du sujets. Je voudrais aussi demander à leurs dirigeants de bien vouloir tenir compte de fait que leurs comités sont communs à l'Association de Météorologie et à la nôtre. Il vous a déjà été parlé du Comité des Instruments. L'existence du Comité de la Standardisation devra faire l'objet de vos délibérations. Il existe cependant aussi un groupe de la classification décimale dont le Dr Friedrich voudra sans doute bien nous entretenir. Quant au dernier venu, le Comité de l'Etude des substances dissoutes, sans faire énormément de bruit, il a obtenu des résultats que je qualifierai de substantiels : bien qu'on ait ajouté nom à ceux des auteurs du rapport, j'avouerai que je suis pour bien peu de chose dans sa réussite.

9. Il est grand temps que je termine, mais avant de le faire je voudrais vous dire mon hommage et mes remerciements pour ceux qui m'ont guidé et assisté et tout particulièrement pour notre sage Président dont la haute valeur scientifique n'a d'égale que sa grande modestie. Merci aussi à nos trois vice-présidents qui m'ont donné une aide et des conseils dont je ne saurais assez leur été reconnaissant.

Je remercie aussi les dirigeants des Commissions et Comités, les auteurs et vous tous enfin dont la participation à cette rencontre sera l'occasion de travaux productifs, mais aussi... fatiguants. Les séances seront en effet longues, nombreuses et chargées en dépit de leur superposion. Je m'en excuse : j'ai fait de mon mieux sans certainement atteindre la perfection.

ASSEMBLÉE GÉNERALE DE HELSINKI

ASSOCIATION INTERNATIONALE D'HYDROLOGIE SCIENTIFIQUE

PROGRAMME GÉNÉRAL

Date	*Heure*	*Salle*	*Réunion*
25/7	10.00		Comité Exécutif de l'Union.
25/7	14.30	F.3.1.	Conseil de l'A.I.H.S.
25/7	16.30		Conseil et Comité Exécutif de l'Union.
26/7	10.00		Séance plénière d'ouverture de l'Union.
26/7	14 ½	F 1.2	Assemblée Générale de l'A.I.H.S. Adresse présidentielle Rapport du Secrétaire
26/7	16 ½	F 1.2	Colloque sur les Sécheresses et les Débits de Base (1re séance)
27/7	9.30	F 1.2	Colloque sur les Sécheresses et les Débits de Base (2me séance).
27/7	15.00	F 1.2	Colloque sur les Sécheresses et les Débits de Base (avec I.A.M.A.E (3me séance).
28/7	9.30	F 1.2	Colloque sur les fleuves à Marée (1re séance).
28/7	9.30	F 2.3	Commission des Neiges et des Glaces (1re séance).
28/7	15.00	F 1.2.	Colloque sur les Fleuves à Marée avec A.I.O.P.
28/7	15.00	F 2.3	Commission des Neiges et des Glaces (2me séance).
28/7	20.00		Commission des Neiges et des Glaces – Films.
29/7	9.30	F 1.2.	Commission de l'Erosion Continentale (1re séance).
29/7	9.30	F 2.3	Commission des Neiges et des Glaces (3me séance).
29/7	15.00	F 1.2	Commission de l'Erosion Continentale (2me séance).
29/7	15.00	F 2.3	Commission des Neiges et des Glaces (4me séance).
29/7	20.00	F 3.7	Ouverture de l'exposition des cartes hydrologiques.
30/7	9.30	F 1.2	Commission des Eaux Souterraines (1re séance). Infiltration saline de la mer.
30/7	9.30	F 2.3	Commission des Neiges et des Glaces (5me séance).

GENERAL ASSEMBLY OF HELSINKI

INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY

GENERAL PROGRAMME

Day	*Hours*	*Room*	*Meeting*
25/7	10.00		Comité Exécutif Union.
25/7	14.30	F 3.1	Council I.A.S.H.
25/7	16.30		Council and Exec. Com. Union.
26/7	10.00		Opening Meeting Union.
26/7	14 ½	F 1.2	General Assembly I.A.S.H. Presidential Address. Report of the Secretary.
26/7	16 ½	F 1.2	*Symposium on Droughts and Low Discharges* (1st Meeting).
27/7	9.30	F 1.2	*Symposium on Droughts and Low Discharges* (2nd Meeting).
27/7	15.00	F 1.2	*Symposium on Droughts and Low Discharges* (with I.A.M.A.P.) (3rd Meeting).
28/7	9.30	F 1.2	*Symposium on tidal Rivers* (1st meeting)
28/7	9.30	F 2 3	Commission of Snow and Ice (1st meeting).
28/7	15.00	F 1.2	*Symposium on tidal Rivers* with I.A.P.O.
28/7	15.00	F 2.3	Commission of Snow and Ice (2nd meeting).
28/7	20.00		Commission of Snow and Ice – Films.
29/7	9.30	F 1.2	Commission of Land Erosion (1st meeting).
29/7	9.30	F 2.3	Commission of Snow and Ice (3rd meeting).
29/7	15.00	F 1.2	Commission of Land Erosion (2nd meeting).
29/7	15.00	F 2.3	Commission of Snow and Ice (4th meeting).
29/7	20.00	F 3.7	Opening Exhibition Hydrological Maps.
30/7	9.30	F 1.2	Commission of Subterranean Waters (1st Meeting). Saline Infiltration from the Sea.
30/7	9.30	F 2.3	Commission of Snow and Ice (5th Meeting).

Day	*Hours*	*Room*	*Meeting*
1/8	9.30	F 1.2	Commission of Subterranean Waters (2nd meeting). a) Saline Infiltration; b) Methods Evaluation of Resources.
1/8	9.30	F 2.3	Commission of Snow and Ice (6th meeting).
1/8	15.00	F 1.2	Commission of Subterranean Waters (3rd meeting). *Symposium on Hydrogeological Maps.*
1/8	15.00	F 2.3	*Symposium on Antarctica* with SCAR.
1/8	20.00	F 3.1	Council I.A.S.H.
2/8	9.30	F 1.2	Commission of Subterranean Waters (4th Meeting). *Symposium on Hydrological Maps.*
2/8	9.30	F 2.3	*Symposium on Antarctica* with SCAR.
2/8	15.00	F 1.2	Committee of Precipitations.
2/8	15.00	F 2.3	*Symposium on Antarctica* with SCAR.
2/8	20.00	F 3.1	Council I.A.S.H.
3/8	9.30	F 1.2	Commission of Subterranean Waters (5th meeting). Radioactive Substances. a) utilisation for the study of Subterranean waters; b) hydrology of Wastes.
3/8	9.30	F 2.3	Committee of Evaporation.
3/8	9.30	F 3.1	Commission of Snow and Ice (7th Meeting)
3/8	15.00	F 1.2	Commission of Subterranean Waters (6th meeting). Evaluation of Resources.
3/8	15.00	F 2.3	Commission of Snow and Ice (Business-Meeting).
4/8	9.30	F 2.3	Committee of Standardisation. Committee of Instruments. Committee of Evaporation.
4/8	15.00	F 1.2	Committee of Dissolved Solids.
4/8	17.00	F 1.2	General Assembly I.A.S.H.
5/8	9.30	F 2.3	Commission of Subterranean Waters (6th meeting).
5/8	9.30	F 1.2	Commission of Surface Waters. Runoff from Snowmelt.
5/8	15.00	F 1.2	Commission of Surface Waters. Different Subjects.
6/8	10.30		General Assembly Union.

Date	*Heure*	*Salle*	*Réunion*
1/8	9.30	F 1.2	Commission des Eaux Souterraines (2me séance) a) Infiltration saline b) Méthodes d'évaluation des ressources.
1/8	9.30	F 2.3	Commission des Neiges et des Glaces (6me séance).
1/8	15.00	F 1.2	Commission des Eaux Souterraines (3me séance). Colloque sur les cartes hydrogéologiques.
1/8	15.00	F 2.3	Colloque sur l'Antarctique avec SCAR.
1/8	20.00	F 3.1	Conseil de l'A.I.H.S.
2/8	9.30	F 1.2	Commission des Eaux Souterraines (4me séance). Colloque sur les cartes hydrologiques.
2/8	9.30	F 2.3	Colloque sur l'Antarctique avec SCAR.
2/8	15.00	F 1.2	Comité des Précipitations.
2/8	15.00	F 2.3	Colloque sur l'Antarctique avec SCAR.
2/8	20.00	F 3.1	Conseil de l'A.I.H.S.
3/8	9.30	F 1.2	Commission des Eaux Souterraines (5me séance). Substances radioactives. a) l'utilisation dans l'étude des Eaux Souterraines; b) l'hydrologie de leur évacuation.
3/8	9.30	F 2.3	Comité de l'Evaporation.
3/8	9.30	F 3.1	Commission des Neiges et des Glaces (7me séance).
3/8	15.00	F 1.2	Commission des Eaux Souterraines (6me séance). Evaluation des Ressources.
3/8	15.00	F 2.3	Commission des Neiges et des Glaces (séance générale).
4/8	9.30	F 2.3	Comité de Standardisation. Comité des Instruments. Comité de l'Evaporation.
4/8	15.00	F 1.2	Comité des matières solides dissolvantes.
4/8	17.00	F 1.2	Assemblée Générale de l'A.I.H.S.
5/8	9.30	F 2.3	Commission des Eaux Souterraines (6me séance).
5/8	9.30	F 1.2	Commission des Eaux de surface. Ecoulement provenant de la couverture de neige.
5/8	15.00	F 1.2	Commission des Eaux de surface. Sujets différents.
6/8	10.30		Assemblée Générale de l'Union.

PROGRAMME DETAILLE

DETAILED PROGRAMME

COMMISSION DES NEIGES ET GLACES

SNOW AND ICE COMMISSION

1re SÉANCE : Glace de mers et de lacs — Neige

SESSION 1 : Sea and Lake Ice - Snow

Jeudi, 28 juillet - 9.30 h

Thursday, July 28th - 9.30 a. m.

1. E. Palosuo (Finland) : Crystal structure of Brackish and freshwater ice.
2. I. Sala (Finland) : Experimental studies on the stress concentration index of sea ice.
3. H. Simojoki (Finland) : Climatic change and the ice observations at Lake Kallavesi.
4. E.R. Pounder and P. Stalinski (Canada) : General properties of Arctic sea ice.
5. E R. Pounder and P. Stalinski (Canada) : Elastic properties of Arctic sea ice.
6. Van Wijngaarden (Netherlands) : Investigations concerning the transport of heat throu a solid sheet of ice in periods of frost and thaw.
7. E.R. Pounder (Canada) : Heat flow in ice sheets and ice cylinders.
8. N. Untersteiner (Austria) : On the mass and heat budget of Arctic sea ice.
9. M. Seppänen (Finland) : On the influence of trees on the accumulation of snow pin dominated forest in Finland.
10. G.D. Rihter (U.S.S.R.) : Development of snow research in the U.R.S.S.
11. M. Shoda (Japan) : New Laboratory of the Snow Experiment Station of the Railw Technical Institute.
12. R.W. Gerdel (U.S.A.) : Wind tunnel studies with scale model simulated snow.
13. W. Price (Gt. Britain) : The artificial deposition of snow in drifts.
14. A.K. Dunin (U.S.S.R.) : The bizzard theory.

2me SÉANCE : Neige Accumulation et Ablation

SESSION 2 : Snow Accumulation an Ablation

Jeudi, 28 juillet - 15.00 h

Thursday, July 28th - 3 p. m.

15. M.N. Akkuratov (U.S.S.R.) : Classification and distribution of avalanches accordin to certain climatic regions of U.S.S.R.
16. Masaki Shimbo (Japan) : The mechanism of gliding in snow.
17. G.D. Richter (U.S.S.R.) : Role of snow cover in nature.
18. P. Salamin (Hungary) : Les facteurs topographiques influençant l'accumulation et la fon de la neige.
19. U. Radok, S.K. Stephens and R.L. Sutherland (Australia) : On the Calorimetric dete mination of snow quantity.
20. V.D. Komarov (U.S.S.R.) : Methods of calculation of the intensity of snow ablatio on the plains.

21. V.D. Komarov (U.S.S.R.) : Movement of water in the snow pores and the calculation of water discharge of the snow cover.
22. A. Bauer (France) : Précision des mesures d'ablation.
23. V.L. Blinova (U.S.S.R.) : The use of hydrochemical methods for investigating the discharge of rivers due to melting of snow and ice.
24. G. Hattersley-Smith, J.R. Lotz and R.B. Sayer (Canada) : The ablation season on Gilman glacier, Northern Ellesmere Island.
25. K.G. Makarevitch (U.S.S.R.) : Distribution of snow on the glaciers of the Zailiysky Alatau.
26. K.G. Makarevitch and G.A. Tokmagambetov (U.S.S.R.) : The preliminary data on the formation of ice in the zone of accumulation of the Tuyuksu glaciers.
27. E.S. Troshkina and J.V. Mahova (U.S.S.R.) : Application of sporepollen analysis in studying the structure of the Elbrus glaciers.

3me SÉANCE : Etudes générales sur les Glaciers — Glacio-Météorologie

Vendredi, 29 juillet — 9.30 h

SESSION 3 : General Glacier Studies Glacio-Meteorology

Friday, July 28th - 9.30 n. m.

28. G.A. Avsiuk (U.S.S.R.) : Glaciological investigations carried out on the U.S.S.R. territory under the programme of the I G.Y. in 1957-59.
29. P. Kasser (Switzerland) : Glaziologischer Kommentar zur neuen in Herbst 1957 aufgenommen Karte 1:10,000 der Grossen Aletschgletschers.
30. A. Desio and A. Marutti (Italy) : Relevés topographiques et géophysiques effectués au cours de l'expédition Italienne au Karakorum K. 2 1953-55 sur certains glaciers du Karakorum.
31. P.A. Cherkasov (U.S.S.R.) : Principal features of the glaciers of the northern slope of the Dzhungar Alatau Mountains.
32. M.V. Tronov (U.S.S.R.) : Some theoretical results of the glaciological exploration in the Altai during the I.G.Y.
33. J. Budel (Germany) : Glaziologische Beobachtungen in Spitzbergen – Barentinsel, 1959.
33a. Krenke (U.S.S.R.) : Nourished Ice Caps on Franz Jozef Land.
34. B. Fristrup (Denmark) : Investigations of four Greenland glaciers.
34a. L. Llibouhry (France) : Les glaciers enterrés et leur rôle morphologique.
35. Jean M. Grove (Gt. Britain) : Some notes on slab and niche glaciers and the characteristics of proto-cirque hollows.
36. L.W. Gold and G.F. Williams (Canada) : Energy balance during snowmelt periods at an Ottawa site.
37. R. Zanetti (Italy) : Radiation temperature of the sky and ablation of ice.
38. W. Ambach (Austria) : Recherches sur le bilan énergétique dans la zone l'ablation de l'Inlandsis du Groenland.
39. A.P. Voloshina (U.S.S.R.) : Radiation and thermal factors in the ablation of glaciers on the southern slope of Elbrus.
40. E.R. Lachapelle (U.S.A.) : Energy exchange investigations on the Blue Glacier Washington.

4me SÉANCE : Influence du Climat sur les Glaciers

SESSION 4 : Response of Glaciers to Climate

Vendredi 29 juillet - 15.00 h

Friday, July 29th - 3 a. m.

41. E.N. Vilesov (U.S.S.R.) : Temperature of ice in the lower parts of the Tuyuksu glaciers
42. R. Finsterwalder (Germany) : Glaciers Fluctuations.
43. L.D. Dolgushin (U.S.S.R.) : Recent glaciation of the Urals and its evolution.
44. L.D. Dolgushin (U.S.S.R.) : Glaciers of Central Asia and their evolution according to latest data.
45. J.B. Case (U.S.A.) : Glacier-mapping activities in the U.S.A.
46. P.L. Mercanton (Switzerland) : Fluctuations des glaciers européens.
47. N.M. Svatkov (U.S.S.R.) : The dynamics of the Scholalsky glacier (Novaya Zemlya) and its dependence on the climatic fluctuations.
48. G. Manley (Gt. Britain) : Meteorological factors in the great glacier advance, 1690-1720.
49. L. Jeretti (Italy) : Observations sur le récent retrait accéléré et anormal de certains glaciers des Alpes occidentales Piémontaires.

5me SÉANCE : Influence du climat sur les glaciers

SESSION 5 : Response of Glaciers to Climate

Samedi, 30 juillet - 9.30 h

Saturday, July 30th - 9.30 a. m.

50. J.F. Nye (Gt. Britain) : The response of glaciers and ice sheets to climate.
51. R.D. Zabirov (U.S.S.R.) : The state of some of the Tjan-Shjan glaciers during the I.G.Y.
52. L.G. Bonderev (U.S.S.R.) : Evolution of some of the Tjan-Shjan glaciers in the last twentyfive years.
53. M.F. Meier (U.S.A.) : Distribution and variation of glaciers in the Western U.S.
54. V.F. Suslov (U.S.S.R.) : Morphological peculiarities and tendencies in the development of ice formation in the North-Western Pamirs.
55. M. Tonini (Italy) : Nouvelles notices sur le glacier Marmolada.
56. V.A. Georgio, A.B. Kazansky, N.V. Kolesnikova, V.K. Nozdrukhine and M.A. Petrossianz (U.S.S.R.) : Le glacier Fedtchenko et le climat.
57. A.V. Shnitnikov (U.S.S.R.) : The present phase of the intrasecular variability of the mountain glaciation in the Northern Hemisphere.

6me SÉANCE : Mesure des Glaciers

SESSION 6 : Glacier Surveyging and Thickness Meanirement

Lundi, 1 août - 9.30 h

Monday August 1st - 9.30 a. m.

59. W. Hoffman (Germany) : Elektronische Vermessung mit Tellurometer auf dem Inlandsis bei der Int. Glaziol. Grönland Expedition; E.G.I.G. 1959.
60. Mälzer-Möller (Germany) : Das Nivellement bei der E.G.I.G.
62. T.J. Blanchut (Canada) : Aerial Photogrammetry in glacier studies.
63. B.A. Borovinsky (U.S.S.R.) : On the question of glacier research by electrical prospecting methods.
64. J.R. Weber, H. Sandstrom and K.G. Arnold (Canada) : Geophysical surveys on Gilman glacier, Northern Ellesmere Island.

5. N.N. Palgov (U.S.S.R.) : Thickness of the glaciers in the Kazakh S.S.R. according to calculations and to seismic measurements.
6. I.S. Berzon, V.A. Pack, V.N. Iakovlev and I.G. Leontiev (U.S.S.R.) : Sondage seismique du glacier Fedtchenko – Observations gravimétriques sur le glacier Fedtchenko.
8. R.L. Shreve (U.S.A. : The borehole experiment on the Blue Glacier, Washington.
9. W.H. Ward (Gt. Britain) : Experiences with electro-thermal boring on Austerdalsbre, Norway, 1956-59.

7me SÉANCE : Mouvements des Glaciers

SESSION 7 : Glacier Flow

Mercredi 3 août à 9.30 h

Wenedsday 3d August : 9.30 a. m.

0. C.R. Allen (U.S.A.) : Structural features on the Blue Glacier, Washington.
1. W. Barclay Kamb : Ice petrofabric data in relation to the structure of Blue Glacier –
2. R. Haefeli (Switzerland) : Zur Rheologie von Eischildern der Arktis und Antarktis.
3. J.W. Glen (Gt. Britain) : Measurement of the strain of a glacier snout.
4. R. Millecamps (France) : Sur une méthode nouvelle d'investigation en glaciclogie.
5. G. Aliverti (Italy) : A propos des ondes des glaciers : aspects du front du glacier du Lys.
6. A. Bauer (France) : Influence de la dynamique des fleuves de glace.
   Mt Olympus – Washington.
7. Bauer : Etudes Nivo – Glaciologiques de 1958 à 1960 (Comité Français).

me SÉANCE :

SESSION 8

Discussions and resolutions on future Policy

Jeudi, 3 août - 15.00 h

Thursday, August 3rd - 3 p. m.

GENDA

) It is proposed by the President that the Commission should undertake the permanent task of regularly recording the quantities which govern and demonstrate the response of glaciers to climatic changes.
Discussion to be introduced by Professor R. Finsterwalder.

) The international Committee on Geophysics (C.I.G.) seeks the Commission's views on the future needs for the international exchange of glaciological data through the World Data Centres.
Discussion to be introduced in relation to World Data Centre «C» (Glaciology) by Dr. G. de Q. Robin, Secretary of the Special Committee on Antarctic Research (SCAR) and Director of the Scott Polar Research Institute.

) Discussion on proposal to hold a symposium on « Glaciers and Climate ». Grindelwald has been suggested as a suitable place to hold the Symposium.

) Appointment of National Correspondents to the Commission.

) Election of Officers of the Commission.

) Any other business.

COLLOQUE SUR LA GLACIOLOGIE ANTARCTIQUE

pendant l'année Géophysique Internationale (organisé par la Commission des Neiges et Glaces de l'A.I.H.S. et le Comité Spécial pour la Recherche en Antarctique)

SYMPOSIUM ON ANTARCTIC GLACIOLOGY

during the International Geophysical Year (organised by the Commission Snow and Ice of I.A.S.H. and the Special Committee for Antarctic Research

Chairman : Dr. G de Q. ROBIN

1re SÉANCE

Lundi, 1er août - 15.00 h

1.C. LORIUS (France) : Etude de l'aucumulation en Terre Adilie.
1a. C. LORIUS (France) : Teneur en deuterium de précipitations dans l'Antarctiq Application au problème de datage des couches de vrévé.
2. R.P. GOLDTHWAIT and R.L. CAMERON (U.S.A.) The U.S.-I.G.Y. Contribution to Antarc Glaciolcgy.
3. S.A. YEVTEYEV (U.S.S.R.) : The Geological activity of the ice cover in Eastern Antarcti
4. T.L. PÉWÉ (U.S.A.) : Multiple Glaciation in the McMurdo Sound area, Antarctica.
5. A. BAUER (France) : Nouvelle estimation du volume de la glace de l'Inlandsis Antarctiq
6. K.K. MARKOV (U.S.S.R) : Glacial eustatic motion of the Earth's crust.
7. H. HOINKES (Austria) : Studies in glacial meteorology at Little America, Antarctica, 19
8. K. SUGAWARA (Japan) : Chemistry of ice, Snow and Other water substances in Antarcti
9. A. CORNET (France) : Déplacement du Glacier de l'Astrolabe.
10. G. ROUILLON (France) : Epaisseur de la calotte glaciaire en Terre Adelie.
11. Mc.LEOD (Australie) : Inland Ice Movement in Mac Robertson land. Antarctica.

2me SÉANCE

Mardi, 2 août - 9.30 h

1. L.D. DOLGUSHIN (U.S.S.R.) : Zones of snow accumulation in Eastern Antarctica.
2. W.W. VICKERS (U.S.A.) : Statistical analysis for tracing accumulation layers in Antarcti
3. R. DINGLE and U. RADOK (Australia) : Antarctic snow drift and mass transport.
4. V.M. KOTLYAKOV (U.S.S.R.) : The results of study of the process of formation a structure of the upper part of the ice sheet in Eastern Antarctica.
4a. V.M. KOTLYAKOV (U.S.S.R.) : The intensity of Nourishment of the Antarctic Ice-She
5. K. SUGAWARA (Japan) : Salt composition of snow, ice and pool water samples collect in Antarctica.
6. H. WEXLER (U.S.A.) : Considerations of the Thermal Structure of the deep ice in By Land.
8. D.J. JENSSEN and U. RADOK (Australia) : Transient temperature distributions in ice ca and ice shelves.

3me SÉANCE

Mardi, 2 août - 15.00 h

1. C.R. BENTLEY and E.C. THIEL (U.S.A.) : Glaciological results of traverse geophysic observations in West Antarctica.

SESSION 1

Monday, August 1st - 15.00 h

SESSION 2

Tuesday, August 2nd - 9.30 h

SESSION 3

Tuesday, August 2nd - 15.00 h

2. E.C. Thiel (U.S.A.) : Results of 1959-60 Airborne traverse.
3. A.P. Crary and P. Van den Hoeven (U.S.A.) : Sub-ice topography of Antarctica.
4. J.A. Bender and A.J. Cow (U.S.A.) : Deep drilling in Antarctica.
5. P.A. Shumsky (U.S.S.R.) : On the theory of glacial motion.
6. J.H. Zumberge (U.S.A.) : Glaciological studies on the Ross Ice Shelf.
7. V.B. Bogoslovsky (U.S.S.R) : Thermal and dynamic glacial regimes.
8. P.A. Shumsky (U.S.S.R.) : The Dinamics and Morphology of Glaciers.

COMMISSION DES EAUX DE SURFACE

COMMISSION OF SURFACE WATERS

COLLOQUE SUR « DEBITS DE BASE ET SECHERESSES

SYMPOSIUM ON «LOW DISCHARGES AND DROUGHTS»

Mardi, 26 juillet - 17.00 h

Tuesday, July 26th - 5 p. m.

1. E. Indri (Italie) : Low Water Flow curves for some Streams in the Venetian Alps.
2. S.N. Kritsky and M.F. Menkel (U.R.S.S.) : Methods of quantitative estimation of lingering Droughts on rivers.
3. W. Laszloffy (Hongrie) : Examen des Basses Eaux.
4. N.A. Baranoff and A.N. Popoff (U.R.S.S.) : Calculation of the minimum Run-off in unexplored Rivers of the Soviet Union.
5. P.J. Wemelsfelder (Pays-Bas) : La persistance des débits d'un fleuve.
6. O. Dub (Tchécoslovaquie) : La définition des bas débits et leur répartition spatiale.
7. J. Benetin (Tchécoslovaquie) : La variabilité des précipitations et des sécheresses en considération du besoin des irrigations dans la région de la Slovaquie du Sud.

7.a J.J. de Aspuru (Espagne) : Les sequiajes del Duero.

Mercredi, 27 juillet - 9.30 h

Wednesday, July 27th - 9.30 a. m.

1. J.V. Sutcliffe and W.R. Rangeley (Grande Bretagne) : Variability of Annual River Flow related to Rainfall Records.
2. C. Russel and E.M. Rasmusson (U.S.A.) : Extended low Flow forecasting operations on the Mississipi River.
3. Roche (France) : Méthode d'estimation des débits d'étiage du faible fréquence.
4. Allan Siren (Finlande) : Occurrence of low Discharge Periods in Rivers in Finland.
5. M. Visentiny (Italia) : Les grands étiages du Po.
6. B. Blacojavic (Yougoslavie) : Drought Classification Mutual relationship of the atmospheric and soil droughts.
7. S.N. Kritsey and M.F. Menkel (U.R.S.S.) : The utilisation of Water Resources of Rivers in Arid Zones.
8. G. Tison jr (Belgique) : Coefficients d'écoulement et perméabilité – Courbes de Tarissement.
9. I. Zsuffa (Hongrie) : La prévision à longue échéance du débit des rivières de la Hongrie en périodes sèches.
10. M.I. Lvovitch (U.R.S.S.) : Changes in the River Run-off in Arid Regions under the influence of Agriculture.

11. E.A. Johnson and H.G. Meginnis (U.S.A.) : Effect of altering forest vegetation on lo flows on small Streams.
12. R.W. Bailey and Otis L. Copcland jr (U.S.A.) : Low Flow Discharges and Plant Cove Relations on two Mountain Watersheds in Utah.
13. A.I. Tcheeotarev and M.S. Pectasjev (U.R.S.S.) : The account of Run-off Charac teristics in the Arid Regions of the U.R.S.S. in hydrological design.
14. A.M. Korvatov and O.V. Popov (U.R.S.S.) : The regulation of the formation of Lo Flow.

Mercredi, 27 juillet - 15.00 h **Wednesday, July 27th - 3 p. m.**

1. Wm Van der Bijl and L.D. Berk (U.S.A.) : Drought Periods at Manhattan, Kansa
2. J. Rodier (France) : Extension de la Sécheresse Exceptionnelle observée en 1958 dan les régions équatoriales.
3. N.J. Cochrane (Grande Bretagne) : The prediction of the Occurrence of Droughts i certain circumstances.
4. F.A. Huff and S.A. Changnon jr (U.S.A.) : Drought Characteristics in a continenta humid climatic region.
5. A.H. Laycock (Canada) : Drought Patterns in the Canadian Prairies.
6. L. Serra (France) : Caractéristiques et causes Météorologiques des Sécheresses Fréquences d'apparition.
7. G.S. Benton (U.S.A.) : Quantitative Relationships between atmospheric vapor Flu and Precipitation.
8. P.F. Vishnevsky (U.R.S.S.) : Influence of Rainfall on summer low-water Flow in th South of the Ukraine.
9. R. Sneyers (Belgique) : Sur la probabilité des sécheresses à Uccle (Belgique) et son in fluence dans la répartition statistique de la côte udométrique.
10. J. Namias (U.S.A.) : Low Water Supply and Periods of Drought.
11. Z. Szigyarto (Hongrie) : Periods without precipitation in Hungary).
12. J. Grindley (Grande Bretagne) : Calculated Soil Moisture Deficits in the Dry Summe of 1959 and Forecast Dates of first appreciable Run-off.
13. A.V. Shnitnikov (U.R.S.S.) : Cyclic Regularities of the General Moisture Supply in th Semi-Arid Zone of U.R.S.S.).
14. M.F. Sribny (U.S.S.R.) : Spring Run-off in Arid Regions.

COLLOQUE SUR LES RIVIERES A MAREE — SYMPOSIUM ON TIDAL RIVER

Jeudi, 28 juillet - 9.30 h **Thursday, July 28th - 9.30 a. m.**

1. J. Grindley (Grande Bretagne) : The determination of the salinity of water in Estuarie
2. G. Tison jr (Belgique) : Relation entre les valeurs des débits d'amont des fleuves à mar et celles de la salinité.
3. J.C. Schonfeld (Pays Bas) : The mechanism of longitudinal diffusion in a tidal rive
4. F. Santema (Pays-Bas) : Water management in the south-western part of the Netherland
5. A.G. Wiersma (Pays-Bas) : Water Management in Delfland.
6. L. Bonnet (Belgique) : Contribution à l'étude théorique des fleuves à marées.
7. S. Baidin and N. Skriptanov (U.R.S.S.) : Investigation of the hydrological regime the Volga Estuarine Region.
8. L. Berthois (France) : Dynamique de la Sédimentation Estuairienne.

9. A. KLEIN (Allemagne) : Ueber die Schwebstoffbewegung in einem Tidefluss auf Grund von Messungen mit radioaktiven Leitstoffen.
0. G. TISON jr (Belgique) : Sédimentation dans les régions amont de la partie fluvio-maritime d'un fleuve à marée.
1. H. SCHULZ und G. STROHL (Allemagne) : Untersuchung der Wanderung von Küstensedimenten mit Hilfe des Isotope Cr^{51}.

Jeudi, 28 juillet - 15.00 h **Thursday, July 28th - 3 p. m.**

1. J. LE FLOCH (France) : Propagation de la Marée dans un canal à variation de largeur exponentielle. Application à la Seine Maritime.
2. C.P. LINDNER (U.S.A.) : Currents in Tidal Reaches of Rivers and their Effect on Shoaling of Side Basins.
3. J. LE FLOCH (France) : Influence du débit fluvial sur la propagation de la marée dans un estuaire.
4. S.A. MORCOS (R.A.U.) : The tidal currents in the southern part of the Suez Canal.
5. D. ROSE (Allemagne) : Die numerische Ermittlung der Gezeitenbewegungen in Tideflüssen.
6. M. BONNEFILLE (France) : Effets comparés du frottement et de l'accélération de Coriolis dans les zones à marée de faibles profondeurs.
7. K.J. BOWDEN (Grande Bretagne) : Circulation and Mixing in the Mersey Estuary.
8. D.W. PRITCHARD and J.R. CARPENTES (U.S.A.) : Measurements of turbulent diffusion in estuarine and inshore waters.
9. D.R.F. HARLEMAN and A.I. IPPEN (U.S.A.) : The turbulent diffusion and convection of saline water in an idealised estuary.

Écoulement provenant de la couverture de neige — Run-off resulting from snow-cover

SÉANCE — SESSION

Vendredi, 5 août - 9.30 h **Friday, August 5th - 9.30 a. m.**

1. P. LIGHT (U.S.A.) : Snow Melt Floods, Spring 1959, Upper Mississipi Watershed.
2. J. MARTINEC (Tchécoslovaquie) : The Degree – Day Factor for Snowmelt Run-off Forecasting.
3. H.W. ANDERSON and C.H. GLEASON (U.S.A.) : Effect of Logging and brush Removal on Snow Water Run-off.
4. L. SERRA (France) : Ecoulement provenant de la couverture neigeuse.
5. D. TONINI et U. PICOZZI (Italie) : Sur le bilan hydrologique de certains cours d'eau du Nord-Est de l'Italie.
6. A. FORSMAN (Suède) : Effect of Air Temperature on Snowmelt Run-off – An investigation at Lake Keklingen.

Communications diverses sur les eaux de surface

7. W.B. LANGBEIN (U.S.A.) : Water Levels as indicators of Long-Term precipitations or Run-off.

8. R.K. Linsley and N.H. Crawford (U.S.A.) : Computation of a synthetic Stream fl Record on a digital Computer.
9. L.T. Fedorov (U.R.S.S.) : Application of composition Methods for computing Run-c
10. S.N. Kritsky and M.F. Menkel : On the regularities of long-term river flow Fluctuatio
11. J. Saarinen (Finlande) : Some observations on discharge in a small ice covered river Finland.
12. T. O'Donnell (Grande Bretagne) : Instantaneous Unit Hydrograph derivation by harmon analysis.
13. F. Lugiez et P. Guillot (France) : Dix années de prévision d'apports à Electricité France.

Etudes diverses

SÉANCE — SESSION

Vendredi, 5 août - 15.00 h — **Friday, August 5th - 3 p. m.**

1. J.E. Nash (Grande Bretagne) : A note on an investigation into two aspects of the relati between Rainfall and Storm Run-off.
2. K. Szesztay (Hongrie) : Water Balance survey of lakes and River Bassins in Hungar
3. Prof. A.N. Befani (U.R.S.S.) : Principles of the theory of precesses of surface and unde ground Run-off.
4. M.F. Sribny (U.R.S.S.) : Torrential Flood Problems.
5. D. Tonini (Italie) : Le potentiel hydroélectrique des cours d'eau italiens.
6. M. Humara (Espagne) : Lluvias y corrientes superficiales en España.
7. G.L. Shvee (U.R.S.S.) : Streamflow Discontinuity of Ukranian Rivers.
8. E.G. Popov (U.S.S.R.) : Ununiformity of surface retention as a factor of surface run-

COMMISSION DE L'EROSION CONTINENTALE — COMMISSION OF LAND EROSION

1re SÉANCE — SESSION 1

Vendredi, 29 juillet - 9.30 h — **Friday, July 29th - 9.30 a. m.**

1. F. Fournier (France) : Débit solide des cours d'eau. Essai d'estimation de la perte terre subie par l'ensemble du globe terrestre.
2. F. Bauer (Allemagne) : Schwebestoffmessungen.
3. J. Tixeront (Tunisie) : Les débits solides des cours d'eau d'Algérie et de Tunisie.
4. M. Van Wijngaarden (Pays-Bas) : The influence of riverworks on the equilibrium the riverbottom in the vicinity of the bifurcations of the River Rhine in the Netherlan
5. N. Koroleff (Finlande) : Chemical composition of lake water from Kallavesi.
6. M. Jaffry (France) : Emploi de traceurs radioactifs pour l'étude du transport soli dans les cours d'eau.
7. C. Vita Finzi (Grande-Bretagne) : Post Roman Changes in Tripolitanian Wadis.
8. J. Tricart (France) : Les modalités de la morphogénèse dans le lit du Guil au cours la crue de mi-juin 1957.

9. M.M. Thurovsev (U.R.S.S.) : Several Methods of quantitative register of soil losses due to water and wind-erosion.
0. P. Surmach (U.R.S.S.) : Artificial Overhead irrigation applied to study the capacity for infiltration of the soil, flowing and washing away.
1. K.L. Kholupyak (U.R.S.S.) : Antierosional arrangement of forest plantations and its quantitative indices.
2. V. Kozlic (Tchécoslovaquie) : Elements of protective effect of hydraulic Erosion Control.
3. J. Dvorak (Tchécoslovaquie) : Surface run-off as factor of water Erosion.

2me SÉANCE — SESSION 2

Vendredi, 29 juillet - 15.00 h — **Friday, July 29th - 3 p. m.**

1. Gazzolo-Bassi (Italie) : Contribution à l'étude du degré d'érosion des sols qui constituent les bassins de montagne des cours d'eau italiens.
2. H. Kuron (Allemagne) : Langfristige Messungen von Abfluss und Abtrag auf drei typischen Boden Deutschlands.
3. G. Filipovski (Yougoslavie) : Erosion von Salz- und Alkaliböden (Solontschak und Solonetz) mit besonderer Berücksichtigung ihrer Nutzung.
4. L. Jung (Allemagne) : Einfluss der Steinauflage auf Abfluss und Abtrag bei Schieferböden.
5. O. Birck (Hongrie) : Influence of Litter of the broad leaved forest on soil conservation.
6. B. Kazo et A. Toth (Hongrie) : Emploi d'un moyen de conditionnement contre l'érosion des sols.
7. Th. Maddock (U.S A) : Erosion Control on Five Mile Creek, Wyoming.
8. N.V. Peterson and R.F. Hadley (U.S.A.) : Effectiveness of Erosion Abatement Practices on Semiarid Rangelands in Western United States.
9. D.L. Armand (U.R.S.S.) : Methods of projecting a network of forest shelterbelts to fight erosion.
0. V.V. Slastichin (U.R.S.S.) : Sur l'évaluation du danger d'érosion provoquée par les précipitations.
1. B.B. Goossak (U.R.S.S.) : On the Mechanism of the Erosion under Furrow irrigation.
2. S. Scorodumov (U.R.S.S.) : About methods of studying of agrotechnical control with the Water Erosion of Soils.
3. O. Dub (Tchécoslovaquie) : La détermination de l'intensité de l'érosion d'eau par les méthodes hydrologiques.

COMMISSION DES EAUX SOUTERRAINES — COMMISSION OF SUBTERRENEAN WATERS

Salinité des Eaux Souterraines le long des côtes et des estuaires — **Saline Infiltration**

1re SÉANCE — SESSION 1

Samedi, 30 juillet - 9.30 h — **Saturday, July 30th - 9.30 a. m.**

1. J. De Jong (Pays-Bas) : The course of the desalinisation of the groundwater after the February 1953 flooding by sea-water of the « Oranjezon » dune area, isle of Walcheren Netherlands.

2. M. Jacobs and S. Schmorak (Israel) : Salt Water Encroachment in the Coastal Pla of Israel.
3. J.F. Mink (U.S.A.) : Flow Geochemical Aspects of Sea Water Intrusion in an Isla Aquifer.
4. F.A. Kohout (U.S.A.) : Flow Pattern of Fresh and Salt Water in the Biscagne Aquif of the Miami Area, Florida.
5. Ü. Bardelli (Italie) : New System of pumping underground fresh water afloat up sea-water in porous formation.
6. D.K. Todd (U.S.A.) : Salt water Intrusion of Coastal Aquifers in the United Stat
7. A.E. Scheidegger (Canada) : Underground Dispersion of Miscible Liquids.
8. F.N. Visher (U.S.A.) : Qualitative hydrodynamics within an oceanic island.
9. H.R. Henry (U.S.A.) : Salt Intrusion into Coastal Aquifers.
10. H. Schoeller : Salinité des eaux souterraines, évapotranspiration et alimentation c nappes.

METHODES D'EVALAUTION DES RESSOURCES

METHODS EVALUTIUS OF RESOURCES

1re SÉANCE

SESSION 1

Lundi, 1 août - 9.30 h

Monday, August 1st - 9.30 a. m.

1. F. Slepicka (Tchécoslovaquie) : Contribution to the solution of the filtration law.
2. A. Vibert (France) : Evaluation des possibilités d'un gisement aquifère profond, da un cas particulier.
3. F.V. Sutcliffe and W.R. Rangeley (Grande-Bretagne) : An Estimation of the lo term Yield of a large Aquifer at Teheran.
4. M.J. Goldschmidt (Israel) : Hydrometeorological Methods of quantitative Estimati of Annual Underground Water Replenishment.
5. J.A. Van 't Leven (Pays-Bas) : Exploration and Exploitation of shallow fresh-water laye in coastal areas.
6. J.C.I. Dooge (Irlande) : The routine of ground-water recharge through typical elemen of linear storage.

6a. D. Dubs (Tchicoolovaquie) : Regime of dependence of Ground-Water table rising zone near the Danube River after its culminations.

2me SÉANCE

SESSION 2

Mercredi, 3 août - 15.00 h

Wednesday, August 3rd - 3 p. m.

7. C.N. de Jong (Pays-Bas) : Non-steady flow of confined ground-water in the case of cor pressible semi-pervious layers.
8. M.I. Rorabaugh (U.S.A.) : Use of Water Levels in estimating Aquifer Constants in finite Aquifer.
9. J.P. Poland (U.S.A.) : Land-subsidence in the San Joaquin Valley, California, and i effect on estimation of Ground-Water Resource.
10. W.C. Walton and J.C. Neill (U.S.A.) : Analyzing Ground-Water Problems wi Mathematical Models and a Digital Computer.
11. H.E. Skibitzke (U.S.A.) : Electronic computers as an aid to the analysis of Hydrolog problems.

2. P. Pouchan (France) : Apport des méthodes hydrogéologiques à l'interprétation géologique des terrains.
3. P.E. La Moreaux and W.J. Powell (U.S.A.) : Stratigraphic and structural guides to the Development of Water Wells and Well Fields in a Limestone Terrance.
4. J. Lorenz (Tchécoslovaquie) : L'évaluation graphique des résultats du pompage dans les nappes aquifères à surface libre.
5. K. Ubell (Hongrie) : Détermination and representation of characteristic data for groundwater household.

CARTES DES EAUX SOUTERRAINES

MAPS OF GROUND-WATERS

1re SÉANCE

Lundi, 1 août - 15.00 h

SESSION 1

Monday, August 1st - 3 p. m.

1. Stretta (UNESCO) : La carte des Zones Arides comme document préliminaire à l'étude des eaux souterraines et l'établissement des cartes hydrogéologiques.
2. N.A. De Ridder (Pays-Bas) : Recherches hydro-géologiques aux Pays-Bas.
3. W.C. Visser (Pays-Bas) : L'aperçu agro-hydrologique des Pays-Bas.
4. A. Wieckowska (Pologne) : Zones Géographiques des eaux phréatiques.
5. T. Celmer (Pologne) : Types of Ground Water Appearing in the Areas of the Post-Glacial Lowland in Poland in a detailed hydrogeographical Mapping.
6. P. Russo (France) : Méthodes par l'établissement des cartes hydrogéologiques.
7. H. Karrenberg (Allemagne) : Die Hydrogeographische Karte 1:100.000 von Nordrhein – Westfalen.

2me SÉANCE

Mardi, 2 août - 9.30 h

SESSION 2

Tuesday, August 2nd - 9.30 a. m.

8. J. Margat (Maroc) : Présentation des cartes hydrochimiques du Maroc.
9. L. Moullard et R. Hazan (Maroc) : Plaine de Berrechid. Etude de la nappe phréatique.
0. R. Ambroggi et J. Margat : Légende générale des cartes hydrogéologiques du Maroc.
1. M.E. Altovsky and N.A. Marinov (U.R.S.S.) : Method of compiling hydrological Maps in Scales 1:1.000.000–1:500.000–1:200.000 and 1:100.000.
2. V.I. Dukhanina, N.A. Marinov and M.V. Churinov (U.R.S.S.) : Main principles and Methods of Compiling Survey (small scale) – Hydrogeological maps of U.R.S.S.
3. B.F. Mavritski (U.R.S.S.) : Types of Hydrogeological Maps compiled during Investigation of Artesian Basins of platform-type.
4. V.G. Tkachuk and E.V. Pinneker (U.R.S.S.) : Areal Hydrological Mapping of some parts of the East Siberia.
5. G. Laclavere : Considération sur la réalisation des cartes hydrogéologiques.
6. M. Gulinck : Cartes des Eaux Souterraines en Belgique.

3me SÉANCE

Vendredi, 5 août - 9.30 h

SESSION 3

Friday, August 5th - 9.30 a. m.

Discussion

TRACEURS RADIOACTIFS

RADIOACTIVE TRACERS

SÉANCE

SESSION

Mercredi, 3 août - 9.30 h

Wednesday, August 3rd - 9.30 a. m.

1. S. Mandel (Israel) : Hydrogeological Field Work with Radioactive tracers in Isreal u to May 1960.
2. C.W. Carlston, L.L. Thatcher and E.C Rhodehamel (U.S.A.) : Tritium as a Hydr logic Tool – The Wharton Tract Study.
3. H.E. Skibitzke (U.S.A.) : Radioisotopes in the Laboratory for Studying Ground-Wat Flow.
4. J.A. Dacosta and R.R. Bennet (U.S.A.) : The pattern of Flow in the Vicinity of a reche ging and discharging pair of wells in an aquifer having parallel Flow.
5. R. Brinkmann, K.O. Münnich and J.C. Vogel (Allemagne) C_{14} Age Determinatio of Deep Ground Waters.
6. F. Neumaier : Erfahrungen bei der Anwendung radioaktiver Isotope in der Hydrologi
7. H. Moser : Nachweisempfindlichkeit und Nachweisgrenze radioaktiver Isotope in d Hydrologie.

CONTAMINATION PAR ELEMENTS RADIOACTIFS

HYDROLOGY OF RADIOACTIVE WASTES

1. J. Bourrier (France) : Méthode d'Etude de la contamination des sols en place par l radioéléments.
2. J.A. Lieberman and W.S. Simpson (U.S.A.) : Practices and problems in disposal of radio active wastes into the ground.

DIVERS

MISCELLENEOUS

SÉANCE

SESSION

Vendredi, 5 août - 9.30 h

Friday, August 5th - 9.30 a. m.

1. J.C. Schofield (New-Zealand) : Relation of Climatic Factors and Ground-Wat Fluctuations at Ruakura New-Zealand.
2. A.B. Biswas (Indes) : Studies on the seasonal Fluctuations of water level and season changes in Chemical quality of Ground-water in the Dehli-Gurgaon region, Punjab an Dehli-States.
3. B. Blagojevic (Yougoslavie) : Possibility of permanent observations of some elemen in the domain of Soil Hydrology.

COMITE DES PRECIPITATIONS

COMMITTEE OF PRECIPITATIONS

SÉANCE

Mardi, 2 août - 15.00 h avec continuation possible le jeudi 4 août - 9.30 h)

SESSION

Tuesday, August 2nd - 3 p. m. (with possible continuation on Thuesday, August 4th - 9.30 a. m.)

1. L. Serra.
2. G. Tschirhart : Note sur la variation temporelle des précipitations.
3. G.R. Kendall : The cube-root-normal distribution applied to Canadian Monthly Rainfall Totals.
4. Prof. Egidio Indri : A Comparison between the precipitations measured during the same period at the « Astronomico » and « Magrini » Observations of Padua.
5. J. Brunet-Moret : Méthode d'analyse de la répartition des précipitations dans le temps et dans l'espace.
6. K. Heigel : Orographisch Bedingte Schwankungen des Niederschlags.
7. J. Grunow : Variationen der Niederschlagsstruktur und ihre messtechnische Erfassung.
8. J. Grunow : Ergebnisse mehrjähriger Messungen von Niederschlagen am Hang.
9. M. Jacquet : Etude de la répartition spatiale des précipitations à l'échelle fine et précision des mesures pluviométriques.
10. A. Bleasdale and L.H. Watkins : A compound rain-gauge for assessing the errors of conventional raingauge measurements.
11. M. Schoeller : Teneurs mensuelles et annuelles en chlore de l'eau de pluie dans le bassin d'Aquitaine.
12. F. Pasteur : Considérations sur la Rosée.

COMITE DE L'EVAPORATION

COMMITTEE ON EVAPORATION

SÉANCE

Mercredi, 3 aout - 9.30 h avec continuation jeudi 4 août - 9.30 h

SESSION

Wednesday, August 3rd - 9.30 a. m. with continuation on Thuesday, August 4th - 9.30 a. m.

1. F.F. Snyder (U.S.A.) : Evaporation of the Great Lakes.
2. Jiri Vasa (Tchécoslovaquie) : The course of free-water evaporation in different periods of time.
3. B. Brockamp und H. Wenner (Allemagne) : Eine neue Verdunstungsapparatur für Binnengewasser.
4. L. Wartena (Pays-Bas) : A method of computing lake evaporation.
5. E.I. Mukammal et J.P. Bruce (Canada) : Evaporation measurements by pan and atmometer.
6. N.E. Riderand and J.R. Philip (Australia) : Advention and Evaporation.
7. O.E. Leppanen and G.E. Harbeck jr (U.S.A.) : A test of the energy-balance method of measuring evapotranspiration.

8. J. Virta (Finland) : Evapotranspiration measurements in a string fen in Northern Finland
9. A.G. Bruggeman (Pays-Bas) : The effect of dry periods on the ground-water storage in some Dutch polders.
10. J.G. Keyman (Pays-Bas) : A test of the aerodynamic method for measuring evaporation
11. S. Susuki (Japon) : Measurements of Evaporation and Transpiration.
12. A. Serner (Tchécoslovaquie) : Method of Measurement and Determination of Evaporation losses from Water-Surfaces.
13. M. Pycha (Tchécoslovaquie) : Water Consumptive Use of Sugar-beet on coarse textured soils.

COMITE DES INSTRUMENTS ET MESURES

COMMITTEE OF INSTRUMENT

SÉANCE

Jeudi, 4 août - 9.30 h

SESSION

Thuesday, August 4th - 9.30 a. m.

J. Prochazka (Tchécoslovaquie) : Notes on the Question of accuracy of discharge measurements with current meter.

G. Buzengeiger (Allemagne) : Automatisches Integrationsgerät mit Schreibwerk für die Auswertung der Wasserstände und Abfluss von Schreibpegeln.

J.B. Schijf : Rapport sur le travail du Comité.

COMITE DES SUBSTANCES DISSOUTES

COMMITTEE OF DISSOLVED MATTERS

1. L. Gherardelli et L. Canali : Enquête sur les caractéristiques chimiques et physico-chimiques des eaux du Pô, à Polesella par la recherche des matières dissoutes dans l'eau au moyen d'analyses chimiques quantitatives et spectrographiques semi-quantitatives
2. W.H. Durum, S.G. Heidel and L.J. Tison : World-wide Run-off of Dissolved Solids
3. A.M. De Grijs (Chili) : Copper dispersion in rivers draining the Chilean Andes between 34° and 41° South Latitude.

. COMMISSION DES NEIGES ET DES GLACES
COMMISSION OF SNOW AND ICE

LETTER OF THE BRITISCH GLACIOLOGICAL SOCIETY
LETTRE DE LA BRITISH GLACIOLOGICAL SOCIÉTY

We think that the following letter of the British Glaciological Society will interest the laciologists.

Dear Sir,

The recent growth of interest in glaciology has given rise to a situation which was not ıvisaged when the original constitution of the British Glaciological Society was drawn up ↓ years ago. The «Journal of Glaciology» has become international in scope, and foreing ıembership of the Society has risen to threequarters of the total membership. The Committee ıerefore feels that the time has come for foreign members to be given an effective voice in the ɔnduct of the Society. The Committee favours changes in the structure of the Society, provided ıey are supported by our oversea members, so that the Society may become more truly ıternational and so that better facilities can be offered to members.

The first change should be the inclusion of members from other countries on the Society's ommittee, of which all present members are resident in the United Kingdom.

Secondly, the growth of local branches of the Society should be encouraged; these could imulate research, organize meetings and possibly publish local bulletins. An important ınction of the branches would be to enrol new members, thereby increasing the Society's ıcome and providing for an enlarged «Journal of Glaciology».

Finally, the name of the Society should be changed, so that it represents more accurately ıe new situation.

Before taking any further steps, the Committee wishes to obtain opinions from glaciologists ıtside the United Kingdom. I therefore invite you to send me your comments on all these roposals as soon as possible.

(Mrs.) Hilda Richardson
Secretary

LETTERS OF USSR CONCERNING GLACIOLOGY
LETTRES DE L'USSR CONCERNANT LA GLACIOLOGIE

ear Colleague,

The USSR National IGGU Committee has again discussed the question of rendering the laciologists more independency in the frame of the IUGG. Enclosed you will find a detailed ote on that subject made by Prof. G.A. Avsjuk, which it would be very well to publish in the UGG Chronicle.

I fully understand that we are rather behind with that proposal. However, I would ask ou to put this problem on the agenda of the Bureau with the view of arranging glaciologists a separate Association or giving them more independence within the Association of ydrology. If the proposal gets an approval of the Bureau it might be discussed by the council f the Union.

This question has been debated several times already, and we believe that there is mu in favour of its positive decision at the XII General Assembly.

Sincerely yours,

(s.) Prof. V.V. Beloussov,
President of the Academy of Siences, USSR
National Committee of Geodesy and Geophysi

Recommendation to organize the Association of Glaciology within the UGGI

At present when the IGY and IGC period 1957-1959 is accomplished a great volume material is being collected of new glaciological observations in a wide scope of glacier phen mena. Thus the necessary approach is made and there are real possibilities to work out t fundamental problems of modern glaciology, i.e. the problem of interrelations between clima and ice formation, the evolution of modern ice formation, zonal an regional ice formatio problems connected with ancient ice formations, their geological activity, problems of influen of ice formation on the nature of the Earth, ect. The effective elucidation of these proble besides theoretical has a great practical significance considering the widening scope of ente prises aimed at the transformation and application of natural process and resources.

In glaciology, especially during the IGY and IGC, peculiar study methods were elaborate and took form. The tasks of glaciology were outlined more vividly.

The successful and ample elaboration of the problems mentioned above needs conso dation of efforts of glaciologists in many countries, it needs international scientific cooperatio

In glaciology more and more attention is being given to questions of the physics an mechanics of the snow and ice, the study of which is necessary for scientific progress of glaciolo and as a basis for the various practical engineering and technical purposes.

However, at present, the existing forms of international scientific cooperation in glacio gical researches in the Commission of Snow and Ice within the IUGG and its Association Scientific Hydrology can no longer cope with the tasks of modern glaciology as its tasks an methods are beyond hydrological approaches to the phenomena under study and posse specific character. The situation with glaciology brings about the necessity of the organizatic of international scientific glaciological association as an organ within the UGGI independe of the Association of Scientific Hydrology, with maintenance of connection between them the part of the influence of snow and ice on hydrological phenomena.

The main tasks of the Association of Glaciology should be : the organization an coordination of international scientific study of the basic problems of glaciology according to th IGY data, the coordination of new glaciological field researches, the arrangement of Sympos and discussions on problems of glaciology, the collection and distribution of information in t field of scientific glaciology.

In August 1958 the Working Group on Glaciology, V CSAGI Assembly, discussed t necessity for an Association of Glaciology within the IUGG. At the meeting of the Commissio of Snow and Ice in September 1958 in Chamonix recommendations were adopted to organi such an Association within the IUGG.

The preparation of the Drafts Rules, of the programme and the other documents of t new Association should, evidently, be entrusted to the Commission of Snow and Ice; especiall participation of Prof. A. Bauer, Vice-President of the Commission, shall be valuable in th work.

It appears that this question could be solved with satisfaction during the XII IUG General Assembly in Helsinki in August 1960.

Sincerely yours,

(s.) Prof. G. A. Avsjuk,
Subsection of Glaciology, USSR
National Committee for Geodesy and Geophysic

POSITION OF AGU COMMITTEE ON THE RUSSIAN PROPOSAL

Synopsis of AGU Committee on Glaciers Meeting, April 27, 1960

This meeting was attended by members Bader, Crary, Goldthwait, La Chapelle, Meier nd invited guest Hattersley-Smith.

The problem of defining our position on the Russian proposal to form a separate Asso- iation of Glaciology in the IUGG was discussed at considerable length. The Committee iembers were unanimous in their belief that glaciologists have had fair treatment under the nternational Association of Scientific Hydrology, and that the consideration given by Professor ison has been especially gratifying. The consensus of opinion was that we should press for etention of glaciology in the IASH, because it was felt that to split off at this time would cause ome immediate practical difficulties and an unnecessary proliferation of organization. The asic difference between Russian and American definitions of the term glaciology is a further omplication. Consideration by other interested groups, such as the AGU Committee on Snow nd Ice, will be required if a seperate Association of Glaciology (in the broad Russian sense) to be established. One member dissented from the majority opinion; his belief was that laciology will soon be recognized as a separate inter-disciplinary science and that action to ecognize this should begin immediately.

(M.F. Meier, Chairman)

.....

It gives me pleasure to present a copy of the report of Mr. Kohler, president of the ommission of Hydrological Commission of W. M. O., to the Excurtive Committee of this rganization.

REPORT BY THE PRESIDENT OF THE COMMISSION FOR HYDROLOGICAL METEOROLOGY

(Submitted by the President of CHM)

. *Establishment of the Commission*

1.1 The Commission for Hydrological Meteorology became effectively established on September 23, 1959, when the required 30 Members had designated experts on the Commission. The election of its President was completed on March 23, 1960.

1.2 Mr. P.I. Miljukov, Chief of the Hydrological Meteorology Section of the Technical Division of the WMO Sceretariat, has been designated as technical secretary of the Commission.

1.3 As of 1 June, 49 Members were represented on the Commission by 95 experts. The membership as of that date is given in the Appendix to this report.

2. *Working Group on Water Resource Development*

2.1 The Working Group on Water Resource Development, established in accordance with *Resolution 2 (EC-XI)*, continued in operation until the Commission was actived in September 1959, when its functions were absorbed in those of the Commission.

2.2 The present report may be regarded also as the final report to the President of WMO on the activities of the working group, called for in *Resolution 2 (EC-XI)*

3. *Water Resource Development Activities*

3.1 A seminar and a symposium treating water resource problems have been conducte within the past year, and arrangements are being made for a second ECAFE/WMO semin to be held early in 1961.

3.1.1. An Inter-Regional Seminar (ECAFE/WMO) on Hydrological Networks w held in Bangkok in July 1959 as a part of the WMO Technical Assistance Programme. Th seminar was arranged to provide training in the design of hydrological networks and in th application of methods for optimum interpretation of inadequate hydrological data. A seri of lectures was presented by each of two consultants—Messrs. G.P. Kalinin (U.S.S.R.) an W.B. Langbein (U.S.A.). Mr. O.M. Ashford of the Technical Division served as co-direct on behalf of the WMO.

3.1.2. A Symposium on Tropical Meteorology in Africa was held in Nairobi in Decemb 1959 under the joint sponsorship of WMO and the Munitalp Foundation. As the title indicate the symposium was broad in scope, and only a portion had direct bearing on water resour problems. Nevertheless, much of the discussion dwelt on subjects such as radar, precipitatio evapotranspiration and water balance, and Professor L.J. Tison (Ghent Univ.) presented series of lectures on hydrological problems in Africa.

3.2 In response to invitations, designated WMO representatives attended a number technical meetings and symposia involving hydrology during the past year. Among these wer

The Sixth Inter-Agency Meeting on Water Resource Development, Rome, July 195

International Association of Scientific Hydrology (IUGG) Symposia on «Lysimeter and «Water and Woodlands», Hannoversch-Münden, Federal Republic of Germany, Septemb 1959.

UNESCO Symposium on «Plant-Water Relationships in Arid and Semi-Arid Conditions Madrid, Spain, September 1959.

The second meeting of specialists on hydrology, convened by the Scientific Council fo Africa South of the Sahara, Yaoundé, French Cameroons, November 1959.

A meeting of consultants on groundwater development, convened by the U.N. Wat Resources Development Centre (New York, February 1960) to review the draft of a repo entitled «Regional Groundwater Development».

3.3. Mention should be made here of the active role of the WMO in the field of water resourc development through the Expanded Technical Assistance Programme and the Special Fun The WMO has been requested to serve as Executing Agency for major Special Fund projec in Chile and in Ecuador, and it appears that other similar projects may be anticipated. Thes projects provide for an extensive expansion of the existing hydrometeorological networks i the respective countries.

4. *Future Plans*

4.1. The first session of the Commission is provisionally planned for April 1961 i Washington, U.S.A. Since the scope of WMO activities in the water resource developmen programme of the U.N. family may be largely dependent upon the discussions at CHM-I, is important that the agenda and the working papers receive the full consideration of a concerned. The members of CHM have already been requested to submit suggestions an comments with respect to the agenda and it is hoped a preliminary draft will be ready for the review by early July.

5. *Action required*

5.1. No item in this report appears to call for action by the Executive Committeee.

Washington, U.S.A.
May 23, 1960.

COMMISSION FOR HYDROLOGICAL METEOROLOGY (CHM)
COMMISSION DE METEOROLOGIE HYDROLOGIQUE (CHM)

President :	Max A. KOHLER
Vice-president :	...
WMO Members : *Membres de l'OMM* :	*Members of Commission* : *Membres de la Commission* :
Australia — Australie	D.N. BODY
	A.F. RAINBIRD
Austria — Autriche	Prof. Dr. F. STEINHAUSER
	Dozent Dr. Werner KRESSER
Belgium — Belgique	L.J. TISON
British East African Territories including the Seychelles Territoires britanniques de l'Afrique orientale et les Seychelles	I.L. ROBERTS
	M.GREHAN
	I.L. WARD
	Dr. H.C. PEREIRA
	D.J. BARGMAN
British West African Territories Territoires britanniques de l'Afrique occidentale	J.R. CLACKSON
Burma — Birmanie	K. RAJENDRAM
	FAM SENG LIN
Byelorussian-S.S.R. Biélorussie-R.S.S.	Andrej A. GLOMOZGA
Canada — Canada	James P. BRUCE
	Robert H. CLARK
Ceylon — Ceylan	A.P. KANDASAMY
China — Chine	CHONG-I HSUEH
Czechoslovakia — Tchécoslovaquie	VLADISLAV KRIZ
Denmark — Danemark	Leo LYSGAARD
	M.F. EBERT
Finland — Finlande	Dr. H. SIMOJOKI
	Dr. J.M. ANGERVO
France — France	P. FONTAINE
	G. REMENIERAS
	J. RODIER
Germany, Federal Republic Allemagne, République fédérale	Dr. Carl KEIL
	Dr. W. FRIEDRICH
Ghana — Ghana	H.O. WALKER
Greece — Grèce	Dr. St. PAPAGIANNAKIS
	G. VLAHOS
Guatemala — Guatemala	Jorge Mario ANDRADE
Hungary — Hongrie	Dr. Jànos BOGÁRDI
	Dr. Ferenc HAJOSY
India — Inde	M. GANGOPADHYAY
	K. PARTHASARTHY
	S.K. GHOSE
Ireland — Irlande	W.A. MORGAN
	F.E. DIXON
	C.J. GILLMAN
Israel — Israël	Martin JACOBS
	Uri MANE

Italy — Italie	Prof. M. Giorgi
	Dr. Ing. T. Gazzolo
	Prof. G. Roncali
Japan — Japon	Dr. Yoshio Kodaira
	Dr. Yonezo Nakayasu
Malaya, Federation	K. Rajendram
Malaisie, Fédération	Fam Seng Lin
Netherlands — Pays-Bas	Prof. Dr. W. Bleeker
	Dr. L.J.L. Deij
Netherlands New Guinea	J.C.C. Vis
Nouvelle-Guinée néerlandaise	J. Bovenberg
New Zealand — Nouvelle-Zélande	N.G. Robertson
	A.D. Benham
Norway — Norvège	Anton Jackhelln
	Reinhardt Sognen
Pakistan — Pakistan	S.N. Naqvi
Philippines — Phillippines	Juanito F. Lirios
Poland — Pologne	Prof. Dr. J. Lambor
	Z. Mikulski
Portugal — Portugal	Mlle Ilda A. Moura
	D.X. de Queiroz
Portuguese East Africa	J.F. Comes Pepe
Afrique Orientale Portugaise	
Portuguese West Africa	A.P.F. da Costa Malheiro
Afrique Occidentale Portugaise	
Rhodesia and Nyasaland, Federation	J.S. Peake
Rhodésies et du Nyassaland, Fédération des	M.D. Barker
Romania — Roumanie	Dumitru Tistea
	Constantin Diaconu
Spain — Espagne	José Maria Lorente Perez
	Manuel Castans Camargo
Sudan — Soudan	S. Zein
	Y.A. Mageed
	A.B.O. Ateiya
	A.A. Wahab
Sweden — Suède	G.L. Nybrandt
Switzerland — Suisse	Prof. Dr. Ing. Jean Lugeon
	Emil Walser
	Peter Kasser
Thailand — Thaïlande	Lt. Cmdr. Dumrong Chareonsook
Union of South Africa	A.J. Dreyer
Union Sud-Africaine	J.M. van der Westhuizen
Union of Soviet Socialist Republics	Dr. Valentin I. Korzun
Union des Républiques Socialistes Soviétiques	Dr. V.A. Uryvaev
United Arab Republic	S.A.M. Hassanein
République Arabe Unie	H.K. Fahmi
	S. Kaddura
United Kingdom of Great Britain and Northern Ireland	R.H. Clements
Royaume-Uni de Grande-Bretagne et d'Irlande du Nord	

United States of America
Etats-Unis dAmérique

Uruguay — Uruguay
Venezuela — Venezuela

Max A. KOHLER
Walter B. LANGBEIN
Franklin F. SNYDER
Srta. Haydée HERNANDEZ
Dr. Amando MICHELANGELI
Dr. Rafaël CONVIT
Dr. Franco COSBI

D. — OTHER ORGANS OF AND SPECIALIZED AGENCIES RELATED TO THE UNITED NATIONS

D. — AUTRES ORGANISATIONS GOUVERNEMENTALES DEPENDANT DES NATIONS UNIES

CENTRE DE DEVELOPPEMENT DES RESSOURCES EN EAU

Premier rapport sur les deux dernières années

Nous reproduisons in extenso le premier chapitre de ce rapport, les autres étant assez brièvement résumés.

CHAPITRE I

Etablissement et fonctions du Centre sur le développement des ressources en eau.

Le Conseil (ECOSOC) a reconnu depuis longtemps que le développement des ressources en eau est d'importance majeure pour le développement économique et constitue un domaine dans lequel la coopération internationale doit jouer un rôle important. Les étapes suivant lesquelles pareille coopération a été établie et renforcée seront brièvement passées en revue pour en arriver à la situation actuelle avec les fonctions qui ont été confiées au Centre.

WATER RESOURCES DEVELOPMENT CENTRE

First Biennal Report

CHAPITRE I

Establishment and Functions of the Water Resources Development Centre

The Council has long recognized that water development is of major importance to economic development and is a sphere in which international co-operation must play a significant role. The steps by which such co-operation has been established and strengthened may be reviewed briefly in order to set in perspective the functions which are now entrusted to the Water Resources Development Centre.

A la suite de la Conférence scientifique des Nations Unies sur la Conservation et l'Utilisation des Ressources, au cours de laquelle la question des ressources en eau reçut une attention très marquée, le Conseil, en mars 1951, tourna spécifiquement son attention sur ce sujet, pour la première fois et dans sa résolution 346 (XII) insista sur la coopération internationale dans le domaine du contrôle et de l'utilisation des ressources en eau. Dans sa résolution 417 (XIV) du 2 juin 1952, le Conseil considéra l'importance de l'utilisation effective et du contrôle des ressources en eau pour le développement économique, le caractère à multiples faces et d'interdépendance des problèmes de l'eau et les contributions qui pourraient provenir des organisations internationales. Il demanda au Secrétaire Général, en consultation avec les Agences Spécialisées et les autres organisations intéressées «d'assumer la responsabilité de l'organisation et de la coordination des activités internationales».

A la suite de cette résolution, des consultations eurent lieu entre les Nations Unies et les Agences Spécialisées le plus immédiatement intéressées et il en résulta, au cours de l'été 1954, la première rencontre interagences sur le contrôle des ressources en eau et sur leur utilisation... Par cette réunion et par d'autres tenues annuellement depuis lors, la coopération a pu être développée. Les activités dans le domaine des ressources en eau sont passées en revue à chaque réunion et un effort est fait pour un travail d'ensemble.

Ces consultations se développent évidemment en parallèle et sont liées de très près aux considérations du Conseil sur les problèmes des ressources en eau. Il a déjà été fait mention des rapports partiels qui sont soumis au Conseil à des intervalles de deux ans. Le Conseil a de plus demandé et reçu un certains nombre d'études sur des problèmes spécifiques. Une de ces études, préparée par un collège d'experts bien connus, s'intéressait à l'«Integrated River Basin Development» et contenait parmi d'autres suggestions, la recommandation que les arrangements existants du Secrétariat devaient être renforcés. Une recommandation du même genre avait été faite à la même session du Conseil par le Sécrétaire Général

Following the United Nations Scientific Conference on the Conservation and Utilization of Resources, at which the question of water received considerable attention, the Council, in March 1951, for the first time turned its attention specifically to this subject and in resolution 346 (XII) emphasized international co-operation in the field of water resources control and utilization. In resolution 417 (XIV) of 2 June 1952, the Council considered the importance of effective use and control of water resources for economic development, the many-sided and interdependant character of water problems, and the contributions that might be made by international organizations. Also, it requested the Secretary-General, in consultation with the specialized agencies and other organizations concerned, *inter alia*, «to assume responsibility for the organization and co-ordination of international activities ».

Pursuant to this resolution, consultations were held between the United Nations and the specialized agencies more immediately concerned, and resulted in the convening, in the summer of 1954, of the first-agency meeting on water resources control and utilization. Through this and similar meetings held annually since that time, co-operation at the working level has been developed. The activities in the water resources field of all the participants are reviewed at each meeting and an effort is made to attain a common approach.

These consultations of course run parallel and are closely related to the Council's consideration of water resources problems. Reference has already been made to the progress reports which are submitted to the Council at two-year intervals. In addition the Council has asked for and received a number of studies on specific problems. One of these studies prepared by a panel of internationally known experts, dealt with *Integrated River Basin Development* and contained, among other suggestions, the recommendation that existing Secretariat arrangements be strengthened. A similar suggestion had been made to the same session of the Council by the Secretary-General, whose view was that, in the light of what

i estimait qu'à la lumière de ce qui avait jà été fait, le temps «... était mûr pour aller l'avant en réalisant une action combinée, niveau international, dans le domaine du veloppement des ressources en eau». mme résultat, le Conseil adopta une olution, dont il est question ci-dessus, mandant l'établissement d'un centre.

Cette recommandation fut exécutée en nvier 1959, et en Juillet 1959, quand le nseil considéra un rapport du Comité ministrative sur la coordination, il note ec satisfaction due le Centre sur le Dévelop- ment des ressources en eau, établi au artier général, «était devenu le foyer de iction concertée des Nations Unies dans domaine des ressources en eau» (résolution 3 A (XXVIII).

La fonction du Centre est de «promou- ir des efforts coordonnées pour le dévelop- ment des ressources en eau». Il s'efforce issi d'assurer une approche commune dans multiples projets de ressources en eau l'utilisation la plus fructueuse des com- tences existant dans les diverses organisa- ns de la famille des Nations Unies. Ses hes individuelles telles qu'elles furent umérées par l'ACC et approuvées par le nseil, sont les suivantes :

a) garder les problèmes communs des ssources en eau en examen continu;

b) coordonner l'étude systématique, par diverses organisations intéressées, des oblèmes relatifs au développement des ssources en eau, en général, et au dévelop- ment des bassins fluviaux en particulier;

c) de renforcer et d'assurer une bonne ordination des activités de l'assistance hnique en matière des ressources en eau;

d) d'assurer dans le cas des rivières ternationales, le rassemblement des données téressantes, l'étude d'essais de programmes d'assurer la liaison;

e) de favoriser les efforts en vue de la daction de la loi internationale applicable développement des ressources en eau;

f) d'assurer la diffusion des informations importance entre les gouvernements et les ganisations intéressées.

Comme section au quartier général des ations Unies, le Centre du développement s ressources en eau, utilise le personnel,

had already been achieved, the time was «... ripe to go further by bringing about integrated action at the international level in the domain of water resources development». As a result, the Council adopted the resolution, referred to above, calling for the establishment of a centre.

This recommendation was put into effect in January 1959, and in July 1959, when the Council considered a report of the Administrative Committee on Co-ordination, it noted with satisfaction that the Water Resources Development Centre, set up at United Nations Headquarters, «had become the focal point for concerted action among United Nations agencies in the field of water resources» (resolution 743A (XXVIII)).

The function of the Centre is «to promote co-ordinated efforts for the development of water resources». It also endeavours to ensure a common approach in the various water resources projects and the most fruitful use of the competence existing within the various organizations of the United Nations family. Its individual tasks as enumerated by the ACC and approved by the Council, are the following:

(*a*) to keep the interrelated problems of water resources under continuous review;

(*b*) to co-ordinate the systematic study, by the various organizations concerned, of problems related to water resources development in general and river basin development in particular;

(*c*) to strengthen and ensure good co-ordination of technical assistance activities in respect of water resources;

(*d*) to foster in the case of international rivers, as appropriate, the collection of relevant data, the study of tentative programme schemes and the bringing together of the parties concerned;

(*e*) to promote efforts towards the formulation of principles of international law applicable to water resources development; and

(*f*) to foster the diffusion of relevant information among Governments and interested organizations.

As an organizational unit at United Nations Headquarters, the Water Resources Development Centre makes use of staff,

les facilités et les expériences dont dispose le Groupe du Développement des Ressources Naturelles dans la branche de l'Economie des Ressources et du Transport et le chef de ce groupe a été désigné comme chef du Centre. La responsabilité de ce groupe embrasse le service des projets des Nations Unies dans les programmes réguliers et étendus de l'Assistance Technique (TAO) dans le domaine des ressources en eau, aussi bien que le travail au niveau mondial dans ce domaine, particulièrement la préparation d'études en réponse à des demandes du Conseil. Une tâche additionnelle incomba au Groupe avec le commencement des opérations du Fonds Spécial et notamment le service des projets du Fonds Spécial dans le domaine de l'eau, pour lesquels les Nations Unies sont l'agent d'exécution.

Une certaine augmentation du personnel devint impérative pour faire face au travail nouveau et pour compléter la compétence technique du Centre. De ce fait, deux experts de haute classe furent désignés pour un terme assez long et des conseils à court terme aidèrent le personnel pour des travaux techniques bien déterminés. Le Centre n'a cependant que des ressources limitées à sa disposition et il rencontra des difficultés pour recruter le personnel qualifié nécessité par ses activités accrues.

Il est prévu que le travail du Centre variera de temps en temps quand des domaines hautement spécialisés seront abordés à certains moments. Pour cette raison, la structure du personnel sera tenue assez souple par l'utilisation continue de spécialistes en rapport avec le travail à fournir, spécialistes désignés en consultation avec les diverses organisations des Nations Unies. Cette méthode de faire face à l'accroissement du travail sera utilisée de préférence au recrutement d'un grand nombre de spécialistes à titre permanent, ce qui serait impraticable, car il «gèlerait» indûment la structure du personnel. Egalement dans l'intérêt de la coordination, un des objectifs de base du Centre, on espère pouvoir tirer certains avantages, techniques et autres, des secrétariats régionaux et des agences spécialisées. Enfin, le Centre continuera à utiliser des conseils à court terme pour compléter son personnel.

facilities and experiences which are availab in the Natural Resources Development Gro in the Resources and Transport Economi Branch, and the chief of that Group has be appointed head of the Centre. The respon bility of this Group embraces substanti servicing of United Nations projects und the regular and expanded programmes technical assistance (TAO) in the wat resources field as well as the work at t global level in this field, particularly t preparation of studies pursuant to reque of the Council. An additional task fell the Group with the commencement operations of the Special Fund, name the servicing of Special Fund projects the field of water for which the Unit Nations is executing agent.

A certain expansion of the staff becam imperative to meet the increased worklo and to supplement the technical competen of the Centre. Accordingly, two high-lev experts were appointed on a long-ter basis and several short-term consultan joined the staff for specific technical task The Centre has, however, limited resourc at its disposal and encountered difficulti in recruiting qualified staff needed to me its increasing activities.

It is anticipated that the work at t Centre will vary from time to time, that that higly specialized fields will be involv at different times. For this reason, the sta structure will be kept flexible through t continued use of specialists on an *ad h* basis, appointed in consultation with t various United Nations organizations. TH method of meeting the increased worklo will be used in preference to the appointme of a large number of specialized staff on permanent basis, which would be impractic since it would unduly freeze the staff structu Also, in the interest of co-ordination, o of the objectives underlying the establishme of the Centre, it is hoped to draw upo the existing technical and other faciliti of the regional secretariats and of the speci lized agencies. Lastly, the Centre will contin to supplement its staff through the us where appropriate, of short-term consultant

Chapitre II (Résumé)

spositions pour la Coordination et l'action concertée.

Au cours de la période initiale de fonc-nnement du Centre, de grands efforts ont développés pour la coordination de ction concertée des diverses organisations s Nations Unies qui participent à la nion annuelle sur les ressources en eau, de ssistance Technique et du Fonds Spécial. plus, le Centre a développé des rela-ns avec certaines institutions en dehors s Nations Unies. Les Organisations des tions Unies et les Agences Spécialisées en estion sont les suivantes : diverses divisions l'ECAFE, de l'ECE, et de l'ECLA, gence internationale de l'Energie Atomique AEA), la FAO, L'UNESCO, La WHO MM.Diverses réunions interagences ont rifié les fonctions des diverses organisations hydrologie et notamment celles de Centre de l'OMM.

Chapitre III (Résumé)

Avancement des projets

Pendant les deux dernières années, un mbre considérable de projets ont été trepris par les organisations des Nations nies : conférences et réunions diverses, ides et rapports, assistance technique et ancière. La plupart l'ont été par les organi-tions agissant individuellement. Une annexe nne la liste de toutes ces interventions.

a) Projets de travaux. La IBRD a ancé 400 millions de dollars au cours de période sous revue pour des travaux ncernant les ressources en eau. En 1959, le nds Spécial a approuvé des dépenses de 9.4 illions de dollars pour des travaux de ce nre sur un total de 31.3 millions de dollars. n tiers des projets repris à l'annexe se pporte aux recherches de base (météorologie t.) Un autre tiers concerne l'agriculture, rtout l'irrigation. Les eaux potables et indus-rielles interviennent pour 1/8, de même e les installations hydroélectriques. Ces rniers projets sont relativement peu nom-

Chapter II (Summary)

Organizational Arrangements for Co-ordination and concerted Action.

In the initial operational period of the Centre, a great deal of effort has been devoted for co-ordination and concerted action of the various United Nations Organizations which participate at the annual interagency meetings on Water Development, the Technical Assistance Board and the Special Fund.

The participants at the considered meeting are: various divisions of ECAFE, ECE and ECLA, the International Atomic Energy Agency (IAEA), FAO, UNESCO, WHO and WMO. The 5th and 6th Inter-Agency meetings were very useful in clarifying the function of the Centre and of WMO in Hydrology.

Chapter III (Summary)

Progress of Projects

During the past two years a considerable number of water resources projects have been undertaken by the various United Nations Organizations concerned. These were in the form of conferences and other meetings, studies and reports and technical and financial assistance. Most were carried out by the organizations individually. They are listed in a special Annex.

a) Operational Projects. The IBRD made a total of loans amounting to nearly 400 millions dollars in the field of water resources in 1958-1959. The Special Fund has approved a total of about 31.3 millions in 1959, of which about 9.4 millions for projects involving water resources development. More than one-third of the projects listed in the annex are devoted to basic survey and appraisal of water resources and to establishment and development of meteorologic, hydrologic and other water services, while nearly another third is closely connected with agricultural development of lands

breux, mais ils sont de grande importance de même que quelques projets d'aménagement fluviaux poursuivant plusieurs buts.

b) Un rapport sur les techniques d'étude des ressources en eau a été préparé por WMO, l'U.S. Géological Survey, la FAO et la WHO.

c) Un rapport préliminaire a été établi pour l'évaluation des débits des rivières en l'absence de séries d'observation suffisantes.

d) L'UNESCO a pris la conduite d'un travail inter-agences sur la terminologie hydraulique et hydrologique. Une première réunion a eu lieu à Rome (à laquelle prit part le Secrétaire de l'AIHS-NDLR).

e) Le développement des ressources en eau souterraine a particulièrement été pris en considération. Un rapport à été établi sur ce sujet par des représentants de diverses agences et par des consultants. Cette question fera l'objet de multiples réunions des diverses organisations. A signaler notamment un colloque de l'UNESCO en 1961 (organisé avec l'AIHS-NDLR).

f) La question de la pollution des eaux est étudiée avec ECE, FAO, WHO et IEAE, pour rassembler une liste d'organisations s'occupant de la question, ainsi que les sources de documentation et une liste d'experts. Une conférence est prévue pour 1961.

g) La question du développement de l'organisation des bassins fluviaux est particulièrement retenue. Un rapport (déjà signalé) sur l'«Integrated River Basin Development» a déjà paru. Les aspects économique et légal seront particulièrement envisagés. Le travail le plus important a cependant été l'aide à l'exécution (par exemple sur le Mekong inférieur).

h) Parmi les autres projets, le Projet Majeur de l'UNESCO pour les Zones Arides

(mostly irrigation projects). Domestic a industrial water supply projects account about 1/8 and hydroelectric power proje also amount for about one-eight but as m of these projects are very large, their rela importance is far greater. Similarly, mu purpose water resources development proje are few in number, but are substantiall scope.

b) A preliminary report on Techniq of Water resources Survey has been pepepa by WMO, the US Geological Survey, F and WHO.

c) Another preliminary report on Riv Flow evaluating in the absence of long te data has been sponsered by the Cen

d) UNESCO took the lead in co-or nating work on water resource terminolo A first meeting took place in Rome with participation of a representative of AI (the secratary).

e) The period under review has b one of concentrated efforts on ground-wa problems. A report has been prepared Groud-Water Development by represen tives of the United Nations, of vari governmental Agencies and several cons tants. Different United Nations Organizati have held or are planning meetings on t subject. UNESCO will namely hold a sy posium in 1961 on Ground-Water Hydrolo (with AIHS).

f) The subject of water pollution I been kept under consideration in cl collaboration with ECC, FAO, WHO a IAEA: a register is being compiled of orga zations concerned with water pollut existing sources of documentation are be surveyed, a roster of experts is being prepar and a Conference is being planned for 19

g) The Council has attached prior to work on integrated river basin developme and a report on this subject has been prepar Work is proceeding along several lin such as the preparation of systematic econ mic and other studies, consideration of le aspects, etc.

However, the bulk of the work on t subject has been of an operational natu (for instance the Work on the lower Meko basin).

h) Among other projects, the Ma Project of UNESCO on Arid Zones has

ient particulièrement en considération ainsi ue les études de développement des bassins et es ressources hydrauliques en Amérique atine.

CHAPITRE IV (Résumé)

Priorités pour actions futures.

a) Les recherches et études déjà effec- uées en Amérique latine peuvent servir de ases pour des recherches analogues dans es pays sous-développés.

b) Des bassins déterminés seront étudiés ans l'esprit du rapport sur l'Integrated River asin Development.

c) Une étude est prévue de la valeur et u coût de l'eau pour divers usages.

d) L'étude de la déminéralisation sera oursuivie.

ANNEXE

ctivités courantes des Nations Unies et de ses Organisations dans le domaine des ressources en EAU.

La table de matière comprend les points uivants :

) Conférences, réunions de travail et séminaires
) Recherches et Etudes.
) Publications
) Assistance Technique et financière.

} au total 38 pages.

be considered. This project is likely to be terminated in 1962 and the next inter-agency meeting has been requested to devote particular attention to the possibilities of future action in this field. Surveys of water resource in Latin America has been taken up.

CHAPTER IV (Summary)

Priorities for further Action

a) Country surveys of water resources and uses.

b) Preliminary surves of selected international river Basins.

c) Value and cost of water for different uses.

d) Demineralization of saline water.

ANNEX

Current activities of the United Nations Organizations in the field of water resources

Table of contents

a) Conferences, working parties and seminars.

b) Research and studies.

c) Publications

d) Technical and financial Assistance.

We only reproduce the list of the presented publications.

PUBLICATIONS

The order of publications corresponds to the sequence of subject categories in section A.

Ground-water Development

The report (see text paras. 39-40), which is being published and addresses itself mainly o administrators in less developed countries, deals with the problems raised by comprehensive levelopment of ground-water resources on a regional basis and ways to meet them so as to obtain optimum results. (WRDC)

Proceeding of the Third Regional Technical Conference on Water Resources Development in Asia and the Far East (1)

The conference, held in Manila in December 1957, dealt with current programmes for water resources development, basic hydrologic data with special emphasis on deficiencies, manual labour and its more effective use in competition with machines for earth work in the region, and government agency versus private contractor in construction of water resource development projects (ST/ECAFE/SER.F/13). [ECAFE]

Report of the Study Group of Experts from Asia and the Far East on Water Resources Development in the United States of America and Europe

Report and observations by a group of thirteen experts making a study tour of the United States, Austria, France and the Netherlands in August-October 1958 (ST/TAO/SER.C/38). [ECAFE/TAO]

Flood Control Journal

A mimeographed quarterly giving up-to-date information about flood control and water resources development projects undertaken by the various countries of the Asia and Far East region as well as the most recent technical developments in the field of interest to the region. [ECAFE]

Map of Gross Surface Hydro-electric Potential in Europe

A map showing the distribution in the form of isophleths for millions of kWh per km² is in preparation. The map will be issued in a number of adjoining sheets, together with an accompanying text. [ECE]

Bibliographic Index of Works Published on Hydro-electric Plant Construction

Following the issuing, at the end of 1957, of a first volume, (1) a second volume of this publication is under preparation. [ECE]

Development of Hydro Power Stations on the Danube - Existing, Under Construction or Projected (2).

An inventory of hydro-electic schemes on the main stream of the Danube, prepared in connexion with the study of possibilities of electric power exchanges between countries of eastern and south-eastern Europe. [ECE]

International Standards for Drinking-water

The report includes chapters on bacteriological, chemical and physical, biological and radiological requirements, laboratory facilities and research investigations as well as technical annexes. [WHO]

Water Supplies for Rural Areas and Small Communities

An abundantly illustrated book, issued as Monograph N°. 42 in October 1959, concerning

(1) United Nations publication, Sales n°. 1959. II. F. 2.
(1) United Nations publication, Sales N° 1957. II. E/Mim. 24.
(2) United Nations publication, Sales N° 59. II. E/Mim. 20.

ethods for the stimulation and development of water-supply programmes, the design and onstruction of various types of small water supplies and their management. [WHO]

ulletin of the World Health Organization

From time to time, the bulletin contains scientific articles on water problems related to ublic health, such as on sewage water treatment in Vol. 20, N°. 4 (1959) and on methods of ater-flow measurement in Vol. 21, N°. 2 (1959). [WHO]

prinkler Irrigation

A development paper published in English, French and Spanish in December 1959, roviding a comprehensive handbook on the subject. [FAO]

VMO Bulletin

A quarterly publication containing numerous articles and reports of interest to both eteorologists and hydrologists. [WMO]

roceedings of the Inter-regional Training Seminar on Hydrologic Forecasting and the Water Balance

The texts of the lectures given by five consultants at the seminar, held in October-November 957 in Belgrade, together with some additional material, were published by the Yugoslav Government. [WMO]

esign of Hydrological Networks

Technical Note N°. 25, reviewing problems relating to planning, organization and functioning of hydrological networks. [WMO]

echiques for Surveying Surface-water Resources

Technical Note N°. 26, reviewing techniques for measuring precipitation, evapotranspiation, streamflow and sediment transport and related problems; the bulk of this Note was ncluded in the WRDC preliminary report on techniques of water resources surveys (see text ara. 34). [WMO]

Measurement of Evaporation, Humidity in the Biosphere and Soil Moisture

Technical Note N°. 21, reviewing methods and instruments used for measuring evaporation, vapotranspiration and humidity in the biosphere and soil moisture. [WMO]

The Climatological Investigation of Soil Temperature

Technical Note N°. 20, reviewing the physical and biological aspects of soil temperature, with emphasis on the relationship to soil moisture and observational techniques. [WMO]

Climatology and Microclimatology

Proceedings of a symposium on arid zone climatology and micro-climatology, organized ointly with the Commonwealth Scientific and Industrial Research Organization of Australia nd held in Canberra in October 1956, were published as N°. XI in arid zone research series. UNESCO]

Arid Zone Hydrology, Recent Developments

A review of researches since 1952 in hydrology in general and hydrogeology in particular, including such branches as utilization of ground water, its geochemistry and the utilization of radioactive tracers, published as N°. XII in arid zone research series. [UNESCO]

Arid Zone

A quarterly newsletter about UNESCO's major project on scientific research on arid lands and related matters. [UNESCO]

PARTIE SCIENTIFIQUE
SCIENTIFIC PART

SUR LA TERMINOLOGIE DES CARTES DES EAUX SOUTERRAINES

Essais de Definition

J. MARGAT

L'établissement de cartes d'eaux souterraines ou hydrogéologiques est actuellement à l'ordre du jour en plusieurs pays et l'on en débat sur le plan international depuis plusieurs nnées.

Ces cartes reçoivent suivant les pays et selon les auteurs des qualifications diverses. Les éalisations et les articles déjà publiés montrent que les conceptions en ce domaine sont galement diverses, ce qui est normal en raison de la variété des objectifs et des problèmes à ésoudre suivant les pays. Mais les différences de qualification ne paraissent pas correspondre usqu'à présent à ces différences de conception. Il nous paraît que les discussions ouvertes sur a question de savoir ce que des cartes d'eau souterraine ou hydrogéologiques doivent ou ne oivent pas représenter, sont en partie dues à l'absence d'une entente générale sur la définition e certains termes, et qu'elles gagneraient en clarté à un accord à ce sujet.

On suggère donc ici pour contribuer à la mise au point d'un langage commun, quelques éfinitions.

1. Le terme «*carte des eaux souterraines*» a et paraît devoir conserver un sens général et eut désigner toute carte représentant une ou plusieurs caractéristiques quelconques des eaux outerraines.

Anglais : *Ground waters map*
Allemand : *Grundwasserkarte*

Les cartes des eaux souterraines ainsi comprises pourraient se subdiviser principalement n :

— cartes hydrogéologiques,
— cartes de ressources en eaux souterraines ou cartes d'exploitabilité,
— cartes hydrochimiques.

Nous proposons donc de ne pas considérer les termes «cartes des eaux souterraines» et cartes hydrogéologiques» comme synonymes, mais de donner à ce dernier terme un sens lus restreint.

2. *Cartes Hydrogéologiques*

Anglais : *Hydrogeological maps*
Allemand : *Hydrogeologische Karten.*

L'objectif essentiel de ces cartes doit être de représenter la situation géologique des eaux outerraines ainsi que les propriétés hydrogéologiques des différents terrains.

Nous pensons qu'une carte hydrogéologique doit conserver les élements essentiels d'une arte géologique, c'est à dire qu'elle doit représenter à la fois la nature (facies lithologique) t la disposition stratigraphique (définie par l'âge) des divers terrains ainsi que les caractères tructuraux. C'est donc avant tout une carte géologique simplifiée en certains points, enrichie t précisée au contraire en d'autres (topographie souterraine de certains niveaux, par exemple).

La représentation des facies lithologiques apporte déjà en soi des indications sur l'ordre de perméabilité mais il est souhaitable lorsque cela est possible, d'exprimer cette caractéristiq des terrains de manière plus quantitative. Toutefois une carte où les indications géologiques réduiraient à des figurés lithologiques ne nous paraît pas mériter complètement la qualificati d'*hydrogéologique*.

Inversement la simple adjonction de points d'eaux et de symboles ponctuels à une car géologique paraît également insuffisante. Une carte géologique normale bien faite peut et do comprendre ces renseignements, surtout à grande échelle.

Une carte hydrogéologique doit donc représenter un minimum de caractéristiques des ea souterraines : pratiquement leur nombre est limité afin de ne pas nuire à la clarté et à l'intel gibilité de la carte. Aussi parait-il souhaitable de s'en tenir ou de donner priorité aux caract ristiques statiques et dimensionnelles : limite d'extension moyenne, profondeur moyenn forme et pente de la surface piézométrique des principales nappes phréatiques ou éventuelleme captives.

En résumé, il nous paraît souhaitable d'entendre par carte hydrogéologique la synthè cartographique des données scientifiques de base : situation géologique des eaux souterrain et caractères géométriques des principales nappes. Dans ce type de carte, les données scie tifiques doivent prendre le pas sur les indications pratiques directes, ce qui est l'objet de cart de ressources en eau.

Un bon exemple de carte hydrogéologique prise dans ce sens est l'*Hydrogeologische Kar von Nordrhein-Westfalen* au 1/50.000, de H.KARRENBERG (U.G.G.I., comptes-rend de l'Assemblée de Toronto, 1957).

Il n'y a pas lieu de s'attacher ici aux nombreux types de cartes spécifiques représenta séparément ou groupés partiellement les diverses caractéristiques cartographiables des ea souterraines (profondeur, puissance aquifère, volumes d'eaux moyen par unité de surfac amplitudes des fluctuations saisonnières, annuelles ou moyennes interannuelles, variabili des volumes d'eau, température et autres caractéristiques physiques, ect...). Il s'agit surtout cartes de travail dont la publication se conçoit surtout pour illustrer des Notices de car hydrogéologique ou des travaux particuliers. Leur dénomination courante est assez explici

3. *Carte de ressources en eau souterraine*

Anglais : *Occurrence of ground waters maps*
Allemand : *Grundwasservorkommen Karten.*

Nous pensons préférable de réserver cette qualification en l'opposant aux cartes hydr géologiques, à des cartes dont le but essentiel est de fournir des indications pratiques et direct ment intelligibles sur les disponibilités en eau souterraine.

De telles cartes ont déjà été dressées et publiées en plusieurs pays. Mais deux notio doivent être ici distinguées, dont la représentation conjointe paraît difficile (1) :

a) l'exploitabilité immédiate en un point donné d'une nappe d'eau souterraine : c'e le débit maximum exploitable permis par la perméabilité et la puissance aquifère local c'est à dire la *transmissivité*. Cette notion peut en outre être complétée par une considérati économique. Mais elle ne tient pas compte des influences réciproques entre des prélèvemen d'eau souterraine voisine ni de l'alimentation de la nappe, dont la valeur limite globalement l prélèvements sans risque de déséquilibre de la balance hydrologique.

On propose de réserver aux cartes représentant cette donnée (exprimée en débit instanta ou journalier) la qualification de *carte d'exploitabilité*.

Anglais : *Drawing from Ground water possibilities maps*
Allemand : *Verfügbaren Grundwassermengen Karten*

(1) Citons toutefois l'exemple de la **Grundwasserkarte der Bundesrepublik Deutschland** a 1/1.000.000, par R. GRAHMAN et W. WUNDT (U.G.G.I., comptes rendus de l'Assemblée de Toront 1957).

On peut citer comme exemple de ce type de carte l'*Hydrogeologische Ubersichtskarte* au /500.000, de R. GRAHMAN (République fédérale allemande).

b) Les ressources en eau souterraine considérées globalement et à long terme, c'est-à-dire a quantité d'eau reçue par une nappe dans un périmètre donné. On l'exprime en module de essource en eau, soit en débit (instantané fictif ou annuel) par unité de surface. On ne peut 'assimiler à la part infiltrée des eaux de précipitations, car d'autres apports d'eau aux nappes outerraines peuvent se produire.

Ce module, évaluable par l'établissement de bilans hydrauliques locaux, correspond aux isponibilités maxima theoriques d'une nappe, mais non à ses disponibilités réelles qui — ompte tenu des modalités de décharge et des exutoires visibles ou occultes de la nappe — ont fonction des possibilités pratiques (techniques et économiques) de modification temporaire u permanente de son équilibre hydrologique. Mais il est plus aisé d'évaluer, par l'établissement e bilans hydrauliques locaux, le module d'alimentation d'une nappe.

On propose de réserver aux cartes représentant cette donnée la qualification de *carte es ressourcees en eau souterraine.*

Anglais : *Occurrence of ground water or Ground water disponibilities map*

Allemand : *Grundwasservorkommen Karten.*

Il ne nous échappe pas que la spécialisation et l'opposition proposée ici entre les termes *xploitabilité* et *ressource* sont en partie formelles et restreignent un peu abritrairement leur ens courant. Mais ce n'est qu'une affaire de convention et il demeure souhaitable de désigner ar des termes distincts des notions distinctes. Dans le cas présent, l'opposition est surtout due, n dernière analyse, au temps auquel est rapporté le volume d'eau *disponible.*

4. *Cartes hydrochimiques*

Anglais : *Hydrochemical maps*

Allemand : *Chemische Grundwasser Karten.*

Ce terme ne prêtera guère à discussion et on s'accordera aisément à le réserver aux cartes yant pour objectif principal la représentation des qualités chimiques des eaux souterraines.

Toutefois une carte hydrochimique générale doit comprendre à notre sens, la représen- ation conjointe des deux données chimiques principales : la *concentration totale* et la *composition* u *facies* défini par les ions prédominants ou d'une autre manière.

On qualifiera de *cartes hydrochimiques spécifiques* les cartes représentant séparément les onnées secondaires (concentrations en certains ions, rapports d'ions caractéristiques, dureté).

Enfin certaines cartes peuvent avoir un objectif pratique et représenter directement les ualités de l'eau souterraine en fonction d'une utilisation (le cas se présente dans les pays de a zone aride où les concentrations des eaux souterraines sont souvent élevées) : il s'agira de *artes de potabilité* ou de *cartes d'utilisabilité pour l'irrigation.*

La combinaison des cartes à objectifs pratiques concernant les ressources (quantitatives) t les qualités chimiques des eaux pourrait aboutir à l'établissement de *cartes de classification es eaux souterraines* pour l'irrigation notamment.

NATIONAL REPORT ON HYDROLOGY FOR THE PERIOD 1957-1959 INDIA

I. HYDROLOGICAL STUDIES AND ALLIED WORK CARRIED OUT IN THE HYDROLOGY & STATISTICS DIRECTORATE OF CENTRAL WATER & POWER COMMISSION

A. Hydrological Studies

(a) Rainfall—runoff studies

1. In connection with the development of hydro-electric potential, runoff studies for number of dam sites in Brahmaputra and Barak river basins were carried out.

2. An analysis of the daily rainfall-runoff data was made at the Bhakra dam site to det mine the respective contributions made to the floods by snow- melt and rainfall.

3. Normal annual isohyets were drawn for the Godavari catchment (upto Pochampa to determine the normal annual yield.

4. Rainfall-runoff studies of the Tapi catchment were conducted.

(b) Storage capacity studies

1. Based on the available data, the storage capacity of Bhimkund reservoir was determin for optimum utilisation.

2. A study was conducted to determine the optimum capacity of reservoir at Gudari Vamsadhara river in Andhra Pradesh so as to meet the irrigation requirements.

(c) Flood discharges studies

1. Studies were undertaken in connection with the adequacy of waterway for rail a road bridges in the Bihar, Uttar Pradesh and Punjab. Suitable values for constant «C» Dicken's formula, depending upon soil characteristics, were recommended for adoptic

2. Detailed studies to determine the design discharge to be adopted for the waterw of Samastipur—Muktapur railway bridge across the Burhi-Gandak in Bihar were mac

3. Studies were conducted with a view to determine the coefficient value of the «C» Dicken's flood formula for the Hadse and Rahar catchments.

4. Necessary flood studies by unit hydrograph method were carried out for Sileru wa project (Andhra Pradesh) and Ramganga dam project (Uttar Pradesh) for the estimation design flood.

5. Preliminary studies regarding the maximum flood discharge of Chilinadai river connection with the Bypore port at Calicut were made.

(d) Statistical studies in hydrology

1. Probability studies of heavy rainfall at a few stations in North Bengal were conducte to find out chance of occurrence of rainfall exceeding 10″.

2. Rainfall-runoff relationship for about eleven projects were established in connectio with the study of estimating the difference in the working tables computed from the actu and estimated inflows.

3. Statistical studies of the trend in sub-soil water-table of various sites and the affecte areas in New Delhi were made.

4. A study on the success of reservoirs based on actual and estimated runoff values was made.

5. To make a statistical study of rainfall pattern in the various river basins, the calculation of the coefficients of variation for the three sub-basins of the Narmada and for the basin of Kangasbati was completed.

e) Storm studies

1. Studies of 11 storms, which affected the West Bengal area, were completed for their depth-area-duration analysis.

2. Depth-area-duration analysis was conducted for the severe storm of 21-22 September 1949 over coastal Andhra near Nagarjunasagar dam site to determine the relationship between depth of rainfall and catchments of smaller areas.

3. Design storm rainfall analysis was carried out for Sharavati river hydro-electric scheme (Mysore). Fourteen storms which affected the catchment were studied and their depth-duration curves prepared.

4. In connection with the design storm rainfall for Vamsadhara catchment upto Gudari and Madanapuram sites, depth-duration curves for selected major storms were prepared.

5. Cyclonic storms and depressions affecting the Chambal catchment above Rana Pratap Sagar dam site in September and October months were examined with a view to find out the depths of rainfall which is carried by them.

f) Allied miscellaneous studies and comments offered.

1. A detailed study of the basins of the problem rivers, Ganga and Brahmaputra, was carried out to find out factors responsible for a succession of heavy floods during recent years in Northern India.

2. The Railway Committee of Engineers referred to the Central Water & Power Commission for approval a list of 23 bridge sites in the jurisdiction of Northern Railway, on which hydrological observations were to be made. Detailed examination was carried out in regard to the nature, type and size of the catchments, rainfall intensities, etc., and additional sites were recommended.

3. Comments were offered on the draft note on linking the Narbada with the Sone and creation of Narbada-Sone-Ganga coast to coast water-way.

4. A proforma incorporating methods and procedural steps for the appraisal of the water resources of the Indian rivers was prepared for the guidance of the various Investigation Circles in estimating the water resources of the various river basins.

5. A comprehensive treatise on the engineering and hydraulic characteristics of the Indian rivers was prepared at the request of the Commandant, College of Military Engineering, Kirkee.

3. Notes, papers, pamphlets etc. prepared

a) The following papers were prepared during the period under review :

1. «Importance of Soil Conservation in relation to Engineering Works».
2. «A statistical study of a succession of droughts and floods».
3. «Preliminary studies for flood control of Mahanadi Delta».
4. «The sampling approach to the estimation of design floods with limited years of data».

b) The following notes were also prepared :

1. «Progress of soil conservation schemes with special reference to river valley projects and flood control projects».
2. «The problem of water logging in the Punjab».

3. «Water Conservancy measures of flood control and drainage and their planning».
4. «Fixation of spillway capacities».
5. «Determination of optimum number of raingauge stations in a river basin».
6. «Design flood for spillways».

A popular pamphlet on «Are flood on the increase ?» was also prepared.

C. Scrutiny of Projects

Comments were offered on the hydrological aspects of about 50 irrigation, power and flood projects all over the country. Following are some of the main projects which were commented upon :

1. Gandak project (Bihar)
2. Mettur Tunnel Scheme (Madras)
3. Yeleru Reservoir Scheme (Andhra Pradesh)
4. Chambal Valley Development Scheme (Rajasthan)
5. Son Barrage project (Bihar)
6. Januari Dam Project (Punjab)
7. Hidkal Project (Mysore).

D. Preparation of «Hydrology» chapters

Chapters were prepared in respect of the following projects :

1. Ken river valley and Nagda Nala projects (Madhya Pradesh)
2. Kopilli Dam (Assam)
3. Bah River Project (Madhya Pradesh).

E. Installation of additional rain and river gauges

1. The implementation of the scheme of setting up additional rain-gauges and observatories in the Himalayan catchments for flood control projects was well underway and the progress achieved in this connection as on 31st March, 1959, is given below :

State	No of rain-gauges proposed	No of rain-gauges installed	Remarks
Uttar Pradesh	13	13	
Bihar	4	4	
West Bengal	3	3	
Nort East Frontier Agency	21	16	These are already existing stations, 12 alternate stations have been accepted in place of proposed stations.
Sikkim	3	3	
Bhutan	20	19	The remaining one station was abandoned in the absence of facilities to maintain this station.
Nepal	61	58	The ramaining 3 stations had to be abandoneddue to the absence of facilities for maintaining these stations.
	Total : 125	116	

2. Proposals were drawn up jointly by the Central Water & Power Commission and India Meteorological Department to strengthen the existing network of ordinary rain-gauges, self recording rain-gauges and evaporation stations throughout the country. According to these proposals, additional 1,250 ordinary rain-gauges, 189 self-recording rain-gauges and 78 evaporation stations would be required over and above the existing number, to give a satisfactory net work throughout the country.

3. The proposal for additional rain-gauges for the Idikki project in the Kerala State was scrutinised and installation of 7 additional rain-gauges was recommended.

4. The inventory of gauge and discharge sites in India was brought upto date as per information received from various states. Copies of this inventory were sent to the Chief Engineers-(F.F.I.) for getting the same checked, scrutinised and corrected.

5. Study of the adequacy of gauge and discharge sites was made and proposals formulated for installation of new gauge and discharge sites. The proposals were sent to the Chief Engineers of the States concerned for scrutiny and comments.

F. Collection and scrutiny of data

a) Water year book

Water year books for the Sabarmati, Mahanadi, Kosi, Manas, Dihang, Narmada, Rapti (for 1955-56), & Tapi (for 1955-56) river basins for the period 1954 to 1956 were compiled and sent for publication.

Drawings and colour guide maps for these basins were also brought upto date and sent for printing.

b) Basin-wise reports.

During the period under review, about 35 basin-wise reports were examined and comments offered thereon.

G. Other items of interest

1. Director (H & S) led a team of Indian Engineers to USA in September 1958 for study of advances made in the fields of Hydrology and Flood Control Techniques.

2. Dr. Ven Te Chow, Prof. of Hydraulic Engineering, University of Illinois, USA visited the H & S Directorate during August 1958 and held discussions on problems of hydrology and hydrological statistics with the officers of this Directorate.

3. A group of five students from the Water Resources Development Training Centre Roorkee, was given practical training in the statistical analysis of the hydrological and hydrometeorological data.

H. Flood Forescating Unit for the Yamuna river

After the floods of July 1958, the Prime Minister set up a Committee under the Chairmanship of the Minister for Works, Housing and Supply for planning measures against floods and similar calamities in Delhi. This Committee at its 3rd meeting decided that the responsibility for study in respect of flood forecasting for the Yamuna river at Delhi and issue of forecasts should be entrusted to the Central Water & Power Commission. Proposals were, therefore, prepared for the setting up of a flood forecasting unit the Central Water & Power Commission to collect, co-ordinate and analyse the data, develop suitable flood forecasting procedures and pass on the flood information to Delhi State Authority who will disseminate the information.

These proposals were approved by the above Committee and the Unit was sanctioned by the Government of India for one year in the first instance with effect from 25.9.58.

The following items of work were undertaken and completed by the Unit as on 31.3.59:

1. Collection of all available gauge, discharge and rainfall data of the Yamuna catchment between Tajewala and Delhi.

2. Correlation studies of discharge data between Tajewala and Okhla discharge sites, and

3. Preliminary work in the development of correlation between gauges at Kalanaur and Delhi.

The Indian Statistical Institute, Calcutta, was also seized of the problem and they were also carrying on the work with the help of electronic digital computer.

1959-1960

1. Studies were made for the preparation of the hydrology chapters for the following projects :

(*a*) Khowai and Gumati river projects, Tripura.

(*b*) Litan dam project, Manipur.

(*c*) Hasdo, Punasa Reservoir and Bah river projects and Upper Wain Ganga Scheme, Madhya Pradesh.

(*d*) Idikki hydro-electric project, Kerala.

(*e*) Tirap and Nambhuk projects, Assam.

2. The hydrological aspects of the following State projects were examined and comments offered.

1. *Irrigation and Power Projects*

(*a*) Dantiwada (Banas), Bor, Purna hydro-electric, Ukai dam, Nalganga, Barna, Tirna projects, Bombay.

(*b*) Pochampad, Thandava & Vamsadhara projects, Andhra Pradesh.

(*c*) Kundah and Periyar hydro-electric projects, Periyar Pumping and Mettur Tunnel schemes, and Parambikulam Aliyar project, Madras state.

(*d*) Palakazhapuzga, Kanhirapuzha and Pumbakakki projects, Kerela.

(*e*) Bhimkund, Utai and Pipal Pankha projects, Orissa.

(*f*) Subarnarekha and Burhi Gandak projects, Bihar.

(*g*) Jamuna Weir and Borpani projects, Assam.

(*h*) Amar Kantak, Madhya Pradesh.

(*i*) Rana Pratap Sagar Project, Rajasthan.

2. *Flood and water-logging schemes*

(*a*) Construction of flood embankment along left bank of river Beas from Tahli to Tawandi Chauderian, Punjab.

(*b*) Jalpaiguri town protection scheme, II phase, West Bengal.

(*c*) Master Plan of Flood Control and Drainage of Kashmir Valley.

(*d*) Anti-waterlogging scheme of Punjab State.

(e) Puthimari Embankment scheme, Assam.

(*f*) Ujina Outfall Drain, Punjab.

(*g*) Yerrakalava project, Andhra.

3. *Basin-wise reports and collection of data.*

A. The following basin-wise reports were examined and comments offered :

(*a*) Puthimari scheme (Vol. III).

(*b*) Sona, Tipkai, Gaurang and Champamathi.
(*c*) Pahumara, Pagladiya, Tiku and Buradhya.
(*d*) Grumani.
(*e*) Monai and Bar.
(*f*) Bilsiri and Gabru.
(*g*) Kulsi and Deosila.

(*a*) Revision of the inventory of gauge and discharge sites in India for the year 1959 and paration of maps were under progress.

(*b*) Co-ordinated proposals for new gauge and discharge sites taking into account the uirements of irrigation, power, flood control, etc. were prepared for the whole country.

Flood forecasting of Yamuna river at Delhi

The flood forecasting unit set up towards the close of 1958 continued its work during the r. Detailed studies of available past data (rainfall, gauge and discharge) were made. Gauge a of Kalanaur Railway Bridge was correlated with the gauge data at Delhi Railway bridge and on the basis of this, co-axial diagrams were prepared. Forecasts of floods when the ge to Delhi Railway bridge would rise above 668.O R L., were issued at Delhi State thorities from 25.7.59, for the whole flood season. The flood forecasts issued were fairly sfactory. Further studies in this respects are being conducted to improve the forecasting hnique for the Yamuna river.

Miscellaneous studies and notes prepared

The following studies and notes were prepared during the year under review :

(*a*) Note on «Determination of spillway capacity in India».

(*b*) Paper on «The sampling approach to the estimation of floods with limited years of a».

(*c*) Note on «Planning of Precipitation net-work in India for the ECAFE Seminar, Bangkok»

(*d*) Note on «The water-logging and salinity problem in Punjab».

(*e*) Studies for «The determination of spillway design flood and dependable yield for Srisai- n project (Andhra Pradesh).

(*f*) Studies for «The estimation of dependable yield at Ukai Dam site».

(*g*) Studies for « The determination of maximum flood Nagarjunasagar Dam site and pendable yield at Vijayawada».

(*h*) «Peak discharge estimation for Gogra at Gangpur, Suswan».

(*i*) Study of «Maximum three-day and four-day rainfall at Allahabad».

(*j*) Note on «Application of Khosla's formula for estimation of annual run-off volumes the Dhukwan and the Rihand catchments.

(*k*) Note on «Rainfall run-off relationship to be adopted for the estimation of yield of the chment for Subarnrekha Irrigation-cum-hydel project.»

(*l*) Note on «The yield and maximum flood for the Mahi project in Rajasthan».

Experts under T.C.M. Programme

(*a*) The services of Mr. W.D. Lawrence (T.C.M. Expert) were obtained for about a month connection with the installation of radio-operated rain-cum-river gauges in the Yamuna chment. In collaboration with the officers of H. & S. Directorate, he conducted radio opagation surveys and selected sites for the installation of radio-operated rain-cum-river uges. With his assistance, one radio-operated rain-gauge was installed in May 1959 at utana, a village on the right bank of the Yamuna.

(*b*) The services of Mr. David M. Rockwood, Expert in streamflow routing in the Army rps of Engineers, U.S.A., were obtained for a period of three months from 10 th September, 59 for imparting training in the technique of streamflow routing to the officers of the Hydro- gy Directorate.

II. CENTRAL WATER & POWER RESEARCH STATION, POONA.

1. *Possible causes of Mahanadi sandspit breach*

The Mahanadi flows parallel to a long sandspit in its lowermost reach to the sea. The ba of the sandspit is reported to have been cut across by the river in 1874, 1936 & 1951. Th examination of the daily discharge variations at Naraj revealed this to be no freak occurren in 1936 or in 1951. The mean rainfall variations over the large catchment (53, 900 sq. mile for 1934-38 indicated to a like conclusion. Rainfall or runoff data for the period round abo 1874 and rainfall data for a large number of rain-gauges in the catchment for 1949-53 we not readily available.

Accordingly a detailed study was made of the 1934-38 rainfall variations for sub-divisio of the catchment. Not only was the peak daily intensity over the delta region below Nar found higher in 1936 than in other years, but the frequencies of moderate and higher inte sities of daily rainfall were also found higher in 1936.

Thus it has been concluded that the 1936 breach of the sandspit was probably caused b the relatively larger frequencies of rainstorms of moderate as well as higher intensities in t delta region below Naraj.

2. *Peak discharges in Brahmani at Rourkela*

Daily discharge observations in the Brahmani at Rourkela were started from 1954 onward The highest daily discharge observed during three years, thereafter, corresponds to 4.06 la cusecs observed on 10 th august 1956. But past reports put that a flood of the magnitude 8 lakh cusecs had occurred in 1920 when a higher rainfall intensity was recorded.

In order to make due allowance for the highest observed flood in the design of the propos weir at Rourkela, the accuracy of the reported figure was examined by the rainfall-runc relations holding for the 1954-56 data. Though the data did not offer in a form suitable f study unit hydrograph method, variants of the method led to the highest estimate bein derived at the average rate of 5 lakh cusecs for a 24-jour period following the storm.

Allowing the usual plus-minus variations about the average rate, it is not impossible f the peak rate of discharge during parts of the day to have attained or exceeded the 8 la cusecs stage.

3. *A form of peak-discharge-estimation formula and ensuing catchment constants.*

The examination of Partial Duration Series of six to eight years' daily observed discharg data of ten sites in the Damodar basin yielded ten expressions of the form

$$Y = \alpha + \beta \log T \quad \ldots\ldots(1)$$

for estimating the peak flood magnitudes of return period T years. The values of α and β the ten sites were found highly correlated with the respective catchment areas, as a result which they were expressed as

$$\alpha = 0.109A^{5/6} \quad \beta = 0.197A^{3/4} \quad \ldots\ldots(2)$$

The form ($y = c_1A^{5/6} + c_2A^{3/4} \log T$) when applied to the data of three sites on the Mah nadi, helped to yield sensibly stable values of c_1 and c_2. The values of c_1 and c_2, obtaining f single site's data on the Tapi and Narmada, nearly agreed with the values of the Damod while those for the Yamuna and the Sone were different from other rivers.

It has been tentatively, concluded that when α and β of expression (1) for any site are expre sed as $c_1A^{5/6}$ and $c_2A^{3/4}$ respectively, the combinations of c_1 and c_2 values obtaining w provide the means of classifying the several river basins in India, from the point of its hydrol gical features and particularly for estimating its expected peak discharge.

Peak discharge estimations with data of partial duration series

The method of analysing daily discharges data by the partial duration series of (i) all ods above fixed magnitudes or (ii) all floods which remain independent (i.e. separated by tain number of days from each other) and also above the fixed magnitudes has been applied he ten sites on five rivers for which observations were available for six to eight years each.

The tentative conclusions derived in 1956 from the application of the method to the data the Sone at Dehri and of the Yamuna at Tajewala ennuciated that

i) the constants α and β were independent of the truncation levels above which the data e selected for analysis,

ii) the values of α and β obtaining from the data of all floods and of independent floods e not necessarily identical,

iii) floods estimates, when deduced from the Partial Duration series data of independent ods, were generally slightly higher than those deduced from the data of all the floods, and

iv) differences between the flood estimates derived by analysing the partial duration series a of the independent floods and of all floods tended to grow smaller by truncating the series ve progressively higher bases.

These were all found to hold true for the new data examined.

Pending further studies, it has been observed that when any set of daily discharge obser-ions covering a six-to eight-year period are analysed by their Partial Duration Series either all floods above three suitable different truncation levels (to include all years on record in h case) or of the independent floods alone above similar levels and the slopes of the best-ng lines do not differ by more than 15 per cent, any of the derived flood estimates upto a years return period may be accepted as correct within a ten per cent margin of error.

Quality of Indian river waters

The water samples collected monthly for the period November 1956 to October 1957 have n analysed for conductivity, pH, sodium, potassium, calcium, magnesium, carbonate, arbonate and chloride and the results obtained conform to the previous year's data. The uble salt content increases considerably for the South Indian rivers like Tapi, Krishna and davari during dry seasons. Hardness number of rivers Kosi, Brahmaputra and Cauvery is ays less than 150 throughout the year. For the rest hardness number is sometimes more than .

Sodium saturation is more than 50 for river Tapi, Krishna and Godavari during dry sons.

A return period formule of daily rainfall intensities

Frequencies were compiled of the different average daily rainfall intensities recorded in ee river basins namely, the basins of the Damodar above Rhondia, of the Tapi above Kathore, l of the Narmada above Broach. Dividing the total length of the data covered by the cumu-d frequencies, the return period (T in years) were evaluted of the different intensities (P) ng equalled or exceeded. On plotting the intensities against log T, six smooth curvilinear ributions were obtained for the six series comprising the data indicating the high degree associated variation between P and T.

Postulating the expression

$$p^r = a + b \log T$$

describing form of the distributions, different tentative values were given to r and the values a and b determined by the method of least squares. The coefficient of variation of P, when tted against r, took the form of U-shaped distributions. Fixing the value of r corresponding he least coefficient of variation as its optimum value, considerable variability of its location ween $r = .5$ to 1 was seen between the different catchments.

In order to gather more evidence holding for similar data, it was thought expeditio in the first instance, to analyse the data already compiled sub-basinwise. By further comp mising a degree of complete independence of the data, the upper sub-basins were allowed have their carry-over effect in the results of the successively inclusive larger sub-basins. T location of the optimum «r» nonetheless continued to be non-fixed. Its range of variabili however, remained confined between $r = .5$ to 1.

7. *Water potential estimation of Tapi basin*

By a judicious co-ordination of the meagre data available for a few non-coalescent ye of the 26 gauge-discharge sites on the Tapi and tributaries, an estimate has been derived of average annual yield of the Tapi basin. Considering the topographical and rainfall features basin was divided into three regions... The estimate of the average monsoon runoff was cal lated for each of the regions from their sub-basins and compared with that obtained for region as a whole. This was done by deriving a suitable form for the rainfall-runoff relation a employing it for each sub-basin. An expression of the form

$$\text{Runoff} = C\ (\text{Precipitation})^n$$

fitted to the June to July, June to August, June to September and June to October cumulatic rainfall and runoff data afforded the best estimates of the monsoon yields. The integra estimates obtained at Kakrapar from the sub-basins were found to agree quite satisfacto with actual observations at the site available.

The accuracies of the several rainfall-runoff relations and of the water-potential estima derived await confirmation on receipt shortly of the rainfall data for later years.

8. *Reliable estimation of long-term floods*

The frequency distribution of the daily flows data as well as of the annual peak dischar rates of most rivers and streams is known to be asymmetrical. The examination of some rece data of the Tapi, Narmada, Yamuna, Sone, Mahanadi and Damodar basins covering differe lengths of time supported the accuracy of previous experience.

Various transformations like logarithmic and Slade's for attaining the classical norm law of distribution, did not prove successful. The lengths of the data available, on the oth hand, were not found adequate for applying Gumbel's theoretical expression utilising annual peaks' data. Following E.W. Lane and Ven Te Chow's return-period (T) concept, expression

$$y = a + b \log T$$

was fitted last year to the data of Partial Duration Series.

While the fit of the linear expression was found reasonably satisfactory for the covera of the large mass of the high discharges data observed over ten to twenty years, further stu disclosed its utter inadequacy for extrapolation purposes on the lower side for which obser data in plenty were on record. When the points for ($\log T$, y) of the complete observed da were plotted, they followed a markedly curvilinear line. Any distribution expression accordin postulated for the data must fully reflect their observed curvilinear features truly in the fi instance before extending its applicability outside for uncovering the unobserved lie.

Availling of its plausible form as

$$y^r = \alpha + \beta \log T$$

the estimate $r = \frac{1}{2}$ was found more efficient than other values for four out of the five lar basins' data. Consequently the estimated values of α and β deduced from different portions the data also showed better invariability. Finally the obtaining flood estimates were mo precise than those obtained by the former straightline expression.

For the purpose of exploiting the expression to basins for which the length of obser data may be less than ten years, alternative means have to be employed for determining

nd β from the slope and size of the basins. The α and β values for ten sub-catchments' data f the Damodar basin showed highly correlated variation with areas in the first instance.

Peak discharge estimations by Slade's expressions

Estimates were deduced of the flood magnitudes of long-term return periods by using ie transformation

$$u = c \log_e d(x + b)$$

ading to Slade's partly bounded distribution function. When 32 years complete daily observed ata and when only single highest floods data from each year of the Sone at Dehri were availed, ie transformation yielded greatly incomparable estimates.

Gumbel's expression on single highest floods data from each year and the Central Water ower Research Station expression

$$y = (a + b \log T)^2$$

ielded still different estimates.

In order to examine how the discrepancies may have arisen from the several expressions aving no upperbound, the transformation

$$u = c \log_e \frac{x - b}{g - x}$$

ading to Slade's doubly bounded expression was availed on the same data. On putting $b = o$ ntatively, the values of g normalising the selected data of 5,4, 3 and 2 highest floods from ach year were determined. The extrapolated estimates now all came out as comparable irre-pective of whether 5, 4, 3 or 2 floods' data were availed only when the optimum g was used.

The optimum g value was better inclined to assume a realistic magnitude of the hypothe-cal upper bound of the extreme floods when deduced from smaller samples' data from ach year. The obtaining long-term flood estimates closely concur with corresponding esti-nates from Slade's partly bounded expression.

0. *Specific discharge-gauge variations in Yamuna above Okhla (1940-57).*

Trends fitted to annual minimum or maximum gauges on streams ignore discharge varia-ions from year to year. Accordingly they cannot be interpreted correctly to reflect the long-term low changes if any operating on the bed of the stream at the gauge site. Trends of specific ischarge gauges instead offer a suitable media for ascertaining such changes.

Graphical presentation of the specific discharge-gauge data for three sites at

Delhi-Gate Pumping Station (6 miles above Okhla)	for 1940-55
E.I. Railway Bridge and Wazirabad	for 1940-57 for 1943-56

n the Yamuna above Okhla discloses an apparent shift in the datum of the levels obtaining or the periods pre-1948 and post-1949, obviously indicating some external factors as operative etween 1948 and 1949. Analysing, therefore, the data of the two periods separately, the ear-to-year changes observed of the specific discharge gauges for different stages of the iver-high and low, rising or falling — were always found statistically insignificant for all the hree sites.

The evidence reflects the absence of any phenomenon like accretion or scour steadily ontinuing from year on the reach of the Yamuna covered by the three gauge sites except nly in a random way.

1. The following hydrological studies were carried out in the Central Water & Power Research tation, Poona, during the year 1959:

(*a*) Long term Peak Rates of Flow by Maximum likelihood method.

(*b*) Precipitation intensities over continued durations.

(*c*) Optimum number of raingauges over a basin.

III. IRRIGATION AND POWER RESEARCH INSTITUTE, AMRITSAR, PUNJAB

Hydrological studies were carried out in respect of the following:

1. *Variation in sub-soil watertable in Canal irrigated tracts of Punjab, India*

Detailed statistical examination of the subsoil water-depth data for the years of availability was carried out to investigate the trend of water-table in respect of tracts irrigated by each canal system. The study revealed that the water-table had been rising in the recent years in case of all the tracts. Average rate of rise of watertable per year during the period considered was also determined in respect of each tract.

2. *Sensitivity of watertable to irrigation and rainfall*

Statistical analysis of subsoil waterdepth, irrigation and rainfall was carried out in respect of the tract comprising of Jandiala Division in the Upper Badi Doab Canal Circle to determine the sensitivity of watertable as affected by irrigation and rainfall.. Significant and positive correlation was found to exist between rise of watertable from June to October an total rainfall plus irrigation from June to September. The relationship deduced between rise of watertable from June to October and total rainfall plus irrigation from June to September led to an important conclusion regarding the amount of water that can be dealt with by the natural agencies such as subsoil drainage, evaporation, transpiration, etc., without causing rise of watertable during the months of June to September.

3. *Intensity and Frequency of flood in Punjab*

In order to determine the frequency and intensity of floods and to know whether the peak discharges were on the increase or not during the recent years, a statistical examination of the data was necessary before any definite conclusions would be arrived at. For this purpose a study was made of the existing data of peak floods of the River Ravi above Madhopur Headworks, River Yamuna above Tajewala Headworks and River Sutlej above Ferozepur Headworks. The main conclusion drawn in each case was that the flood in the recent years have been of increased intensity.

4. *Estimation of Quantum of Discharge expected in Uhl and Lambadag Rivers for Mandi Hydro Electric Plant.*

The study revealed that the discharges in the Uhl catchment area were on the increase inspite of the fact that rainfall was almost uniform. Further variation in year to year discharge was very much at random and a good supply year was likely to be followed by a good or bad supply year.

5. *Waterlogging in Punjab — its causes and cures*

The problem of waterlogging has assumed serious proportions in the State of Punjab. Huge areas of once fertile and cultivated lands have become marshy on account of standing water or because of watertable having come too near the surface. The problem was examined in certain details in the Institute & the main factors responsible for the rise of watertable and consequent waterlogging conditions were investigated and suitable measures were evolved

V. IRRIGATION RESEARCH INSTITUTE, ROORKEE, UTTAR PRADESH

noff studies of Bundelkhand Catchments

nvestigations were carried aut on a relationship between rainfall and runoff for two ent catchments in Bundelkhand, namely, Betwa at Dhukwan and Ken at Gangao. ugh rainfall is confined within the same range of 30 to 60", the percentage runoff was l to be different in the two catchments. For the Betwa, maximum and minimum runoff onships were worked out as follows:

$$\text{(i)}\quad R = 0.44\ P - 4.5$$
$$\text{(ii)}\quad R = 0.42\ P - 11.7$$

e R and P denote runoff and precipitation in inches. For the Ken, the runoff was found more or less uniform round about 10 to 14". The regression equation for maximum runoff en by the following equation

$$R = 0.23\ P - 6.3$$

he Betwa, percentage runoff varied from 8 to 34% with a mean off 24.41, while for the Ken sponding percentage varied from 20 to 42% with a mean of 28.4%.

nit Hydrograph studies for a few rivers of Eastern Uttar Pradesh

Unit hydrograph studies were carried out for four flood rivers of Eastern Uttar Pradesh, ly, Kunra, Rihini, little Gandak and Rapti. The catchment areas vary from 490 to 7,000 e miles.

Unit hydrographs were worked out for two to three storms of 1956. The duration of the is varied from 9 to 14 days. In the case of smaller rivers,, the peaks were sharper and l for a shorter period, while in the case of bigger rivers, the tendencies were reverse for the s.

udy of Evaporation losses

Evaporation data, recorded at the Meteorological Observatory, Bhadrabad for four ent types of evaporations pans for the year 1956 were analysed mainly with the idea of tes- he well known Carl Rohwer formula connecting daily evaporation with daily meteorolo- data. It was found that with slight modifications in the coefficient for the different pans, formula was applicable for Indian catchments. The evaluated coefficients were 0.36, 0.84 for 4' diameter Weather Bureau land pan, Colarado sunken pan and U.S. Geological y floating pan respectively, instead of 0.771 as given by Carl Rohwer.

Evaporation was found to be highest in May and lowest in December and January. Yearly evaporation was found to be of the order of 5'. On this basis, it was estimated that vaporation losses accounted for 1 to 14 per cent of the total runoff for some of the storage voirs in Bundelkhand.

ainfall & runoff studies for the Yamuna and Ganga catchments

Analysis of rainfall and runoff data for the last 29 years, was carried out for two adjacent alayan catchments, namely, the Yamuna at Tajewala and the Ganga at Hardwar. The rainfall for the Yamuna is 65 inches with 54.54% of runoff, while the corresponding es for the Ganga are 63 inches with 71.27% of runoff. The difference in the behaviour of ff with rainfall is attributable to two causes, namely, a higher mean altitude and a higher ntage of perpetual snow zone for the Ganga catchment.

5. *Study of Ganga River discharge probabilities at Raiwala in pre- and post-monsoon pen*

Probabilities of occurrence of discharge of the Ganga at Raiwala were worked outt six ranges from 10,500 to over 14,500 cusecs in order to investigate the availability of supp for raising the capacity of the Upper Ganga Canal from 10.500 to 15,000 cusecs. It indicated that the supplies were adequate during June and the first half of October, while were quite inadequate during the second half of April and November. During the interve period, the probability of getting the increased discharge was about 50%.

6. *Unit hydrograph studies for the Kuwano at Basti*

Unit hydrograph studies were carried out for a flood river of Eastern Uttar Prac namely, the Kuwani near Basti. The catchment is plain in the lower region and densely veget in the upper portion. It was found that the peak of the unit Hydrograph was flat, while the of 17 days, the percentage of runoff to rainfall being only 20%.

7. *Rainfall-runoff studies for some catchments in Uttar Pradesh*

Rainfall-runoff data for thirty years for five Bundelkhand catchments, namely, G Ghaghar, Ghori, Sukhra, Karamnasa and one Himalayan catchment, namely, Sarda analysed. The percentage of runoff to rainfall was found to be much higher for the Himala catchments, being of the order of 60% to 70% as against 40% to 60% for Bundelkhand ca ments.

It was found that not only there was dissimilarity in rainfall-runoff relationships betw the Himalayan and Bundelkhand catchments, but there were wide variations even am catchments of the same region. Empirical relationships, deduced for each catchments, i cated that some were linear and some exponential.

8. *Unit hydrograph studies for the Ami and Ban-ganga rivers of Eastern Uttar Pradesh*

Unit hydrograph studies were carried out for the Ami and Maghar and the Banga at Shohratgarh. The former is a plain catchment, while the latter is hilly, vegetated and woo inits upper reaches. The base of the unit hydrograph was found to be 19 days for the Ami 3 days for the Banganga, the percentages of runoff to rainfall being 24% and 45% respecti The difference was attributable to the flashy nature of the Banganga. while the Ami catchr is characterized by flat slopes, lakes and ponds, depressions and greater flood absorp capacity.

9. *Flood frequency studies for the Yamuna, Ganga, Sarda and Rapti Rivers*

These were carried out, on the basis of thirty to sixty years' data by the modi California, Foster's (Type I and Type III curves), Gumbel's and Ven Te Chow's meth the catchment areas varying from 4,000 to 10,000 sq. miles.

An estimation of probable maximum floods with return period of 10 to 1,000 years carried out in each case. For the Yamuna, the maximum recorded flood was 563,000 cu in 1947, the probability of whose occurrence was once in 100 years, while for the Ganga corresponding figure was 675,000 cusecs in 1924 with a probability of once in 300 years

10. *Qualitative analysis of ground water resources in certain Doabs of Uttar Pradesh affected by Tubewell Pumping.*

The bahaviour of ground water-table was studied for three doabs: (i) Doab No. 1, Hin River and Eastern Yamuna Canal, (ii) Doab No. 4, Kali Nadi (East) and Upper Ga Canal, (iii) Doab No.7 April, Ramganga Doab. No danger of overpumping was indic

ny of the Doabs. Moreover, there was enough scope for further development of ground r resources, although such scope was limited for April-Ramganga Doab, 80% to 90% hose resources were already being tapped in the areas under pumping.

Sediment accumulation studies for some catchments of Bundelkhand, Uttar Pradesh.

Sediment accumulation studies for eleven reservoirs of Bundelkhand with varying sizes to 10,000 sq. miles were studied on the basis of data for capacity surveys. Most of the ments are rocky. The behaviour of the rate of sedimentation was studied with respect vo factors, namely, catchment size and capacity-watershed ratio. For the first factor, en oximately hyperbolic curve was indicated. The rate of sediment accumulation was found of the order 20 acre-feet per 100 sq. miles of catchment for sizes between 3.000 to 9,000 sq. . For catchments below 100 sq. miles, this rate varied steeply from 20 to 400 acre-feet per q. miles of catchment.

Comparison of discharge with current meter and velocity rods

The observations of discharge with current meter at 0.6 depth and velocity rods of 0.8 0.9 depth, undertaken at (i) Dhanauri discharge site at Mile 13-3-0 of Upper Ganga Canal, Kalsia (pucca) discharge site at mile 17-2-0 of Eastern Yamuna Cana, (iii) Belra discharge t mile 43-6-330 of Upper Ganga Canal since 1956, were analysed statistically. Relationship deduced for each site between (i) V_{CM} and $V_{0.8D}$ and and (ii) V_{CM} and $V_{0.9D}$ besides discharge relationship.

Flood studies of River Ramganga

rological studies of the Ramganga were carried out with a view to work out the maximum l discharge and the most adverse design inflow hydrograph for fixing maximum reservoir tion, after flood routing and working out the optimum flood for the design of spillways. The maximum design flood was estimated by (i) empirical formulae, (ii) unit hydrograph od and (iii) flood frequency methods. Whereas Dicken's and Inglis' formulae gave the mum flood with recurrence intervals of 100 years, Creager's formula figure corresponded recurrence interval of 2,000 years, the same by the world enveloping method being ined with a recurrence interval of above 10,000 years. The unit hydrograph method gave quency of recurrence of 500 years with the design of normal maximum flood as 340,000 s. This was recommended as the normal maximum for design of spillway capacity.
The diversion works during the construction period, usually designed for a flood of rence interval from 20 to 100 years, was recommended as 200,000 to 250,000 cusecs.

Analysis of silt samples from Khatima Power House and Pathri Power House

The runner vanes of turbines at Khatima hydro-electric power station on Sarda Canal shown considerable erosion within the short period they have been in operation.
The manufactures have attributed this to the extraordinary type of solid contents of the r in Sarda Canal, suspended and bed silt samples were collected from upstream and nstream of Khatima Power House. For the sake of comparison, suspended and bed silt les were also collected from upstream and downstream of Pathri Power House.
From the analysis of the samples collected, it is seen that (i) average silt content (in grams/ was generally higher at Khatima Power House than at Pathri Power House; (ii) average ted mean size of suspended silt in m.m. generally ranges between 0.1 and 0.3 mm at the places.
The site engineers have been advised to collect some more samples and to analyse them rder to arrive at conclusive results.

15. *Discharge observations on Ganga river below Rajghat-Narora Railway Bridge.*

Systematic gauging of Ganga river below Rajghat-Narora Railway Bridge with the H of a current meter was started in the year 1956 and continued during the monsoon perio 1957 and 1958. One hundred and forty-four discharge measurements were carried out du the three monsoon seasons. On the basis of all these observations, a stage discharge curve been prepared for the above mentioned site. A tentative gauge discharge table has also b prepared for the gauge range from R.L. 583,00 to R.L. 590,00 T.M. N°. 29. R.R. (Hy-

V. INDIA METEOROLOGICAL DEPARTMENT

1. *Hydrometeorology :*

(i) A network of 37 hydromet observatories was established in the Himalayan area du the period bringing their total number in the Himalayan region to 166.

Recommendations for setting up of 1.200 additional raingauge stations were made various State Governments through the River Commissions, in order to ensure adequac data for various hydrological investigations.

(ii) The monthly and annual rainfall data (amounts as well as number of rainy d in respect of about 3,500 rain-gauge stations in the country for the period 1901-1950 w checked up and punched on Hollerith cards. The normals of monthly and annual rainfalls number of rainy days of all the rain-gauge stations were calculated.

(iii) The daily rainfall data of 342 selected stations for the period 1901 to 1950 are b brought into a form suitable for Hollerith punching. The data of about 20 stations have alre been punched and tabulated and their daily rainfall normals calculated.

(iv) Arrangements were made for the preparation of special base maps showing r gauge stations, river catchments, contours, etc., for use in rainfall studies proposed to undertaken during the Second Five year Plan period.

(v) Systematic analysis of major storms which have affected various parts of the cou is being carried.

2. *Symposia and Seminars*

A symposium on «The Meteorological and Hydrological aspects of Floods and Drou in India» was held in April, 1958 at New Delhi under the auspices of the India Meteor gical Department an the Indian Meteorological Society. The papers and the proceedings h been published as a single volume by the India Meteorological Department.

A paper on 'Rainfall Intensities for Local Drainage Design' by K. Parthasarathy Gurbachan Singh was presented at the Inter-Regional Seminar on Hydrological Netw and Methods held at Bangkok in July, 1959.

VI. ENGINEERING RESEARCH LABORATORY, ANDHRA PRADESH

Estimation of the Dependable yields from a catchment

Annual yields received from different catchments of the various rivers and stre flowing through the State of Andhra Pradesh in India, show periodicity. This means that annual yields received from these catchments can be expressed by the formula

$$Y_r = a_o + \sum_{i=1}^{k} a_i \sin\left[\theta_i + \frac{2\pi\,(r-1)}{n_i}\right] + d_r$$

where Y_r is the annual yield observed in the $_r$th year of a series of years,

a_i, θ_i and n_i are the amplitude, phase angle and the periodicity of each of the various cyclic components contained in the annual yields,

d_r is the random fluctuation in the annual yields and a_o is the average annual yield from the catchment.

Major basins contained in the Sate of Andhra Pradesh are the Krishna and the Godavari basins. Yields received from these basins show two definite groups of periodicities i.e. periodicities of 16 and 23 and submultiple years. Further, it is seen that cyclic components having periodicities of 16 or its submultiple years have a lesser amplitude for a unit aera of catchment than those having periodicities of 23 or its submultiple years. Owing to the above cyclic components in the data of the annual yields, estimates of dependable yields based upon the data for different lengths of periods, vary. This variation is sometimes of the order of 15 to 20% and therefore cognisance of the cyclic components in the data of the annual yields should always be taken into consideration in the estimation of the dependable yields.

1959

1. Hydrometeorological data were collected from all the observatories set up for the purpose in the Himalayan and other river catchments, scrutinised and processed for publication. The daily rainfall data of the stations in the Kosi catchment for 1957 and those for the upper Gandak, Gogra, etc., catchments in the Himalayas for 1956 were got printed. Many of these observatories were inspected.

2. Some of the States have started implementing the recommendations for starting additional raingauges to meet the basic needs for various hydrological investigations. The scheme of inspection of all raingauges in India periodically by the Meteorological Department was put into operation.

3. The meteorological features and rainfall distribution associated with the major floods of 1959 were studied. Rainfall Intensity-Duration-Frequency studies were continued. Systematic analysis of past rain storms over different parts of India was continued and a good number of storms over the Punjab-Uttar Pradesh area and over the central parts of the country were completed.

4. The normals of monthly and annual rainfalls of all raingauge stations in the country, based on available data for the period 1901-1950, were converted from inches to milimetres. Fair copies of the converted normals were prepared and supplied to the National Atlas Organisation, Calcutta for use in connection with the compilation of the Drainage Map of India to be included in the English edition of the National Atlas.

5. The normals of rainfall and number of rainy days in respect of all the districts in eight states were calculated.

6. The tabulation of the daily rainfall data of 342 selected raingauge stations for the period 1901-1950 in a form suitable for punching the data on Hollerith cards was continued. The data of 92 stations have so far been tabulated and the data of 28 stations punched.

7. 8 out of the 25 sections of the base map showing raingauge stations, river catchments, contours, etc., were completed and sent to press for printing.

8. The punching on Hollerith cards of the daily rainfall data of all raingauge stations in the country for the years commencing from 1951 was continued. The data of the raingauge stations in all the states except Mysore, Andhra, Rajasthan and Madhya Pradesh for the period 1951 to 1955 have so far been punched.

It has been proved, both by theoretical considerations and by studying the data of the annual yields received from the various rivers and streams flowing through the Andhra Pradesh, that when the estimation of the dependable yields are obtained by utilising the data of the annual yields for years equal to the dominant periodicity of the cyclic functions contained in them, the variation of these estimates is minimum. Thus the estimates based on the above principle are the most efficient estimates.

Periodogram analysis, correlogram analysis are the methods generally used for finding out the dominant periodicities of the cyclic functions contained in any data of the annual

yields. These analyses require a data of annual yields for a good length of the period which is generally not available for Indian rivers. A new technique based upon the variance of cyclic components contained in the data of annual yields for groups of years equal to two, three and so on has been developed for finding out the dominant periodicities of cyclic functions. It is observed that if the groups of years are taken as abscisseas and the above variances as the ordinate, the curve obtained from the data will show minima for the dominant periodicities of the cyclic functions contained in the data of the annual yields.

On the basis of the above knowledge regarding the periodicities of the various cyclic functions contained in the data of the annual yields, estimates of the amplitudes and the phase angles of these cyclic functions are generally found by fitting Fourier series of 12 or 24 terms. However it is observed that when the available data of annual yields is only for 50 or 60 years, the above analysis is not successful. A new method of approach for the estimation of amplitudes and the phase angles of the various cyclic functions contained in the data of the annual yields is developed.

On the elimination of the cyclic functions contained in the data of the annual yields, the resulting data will comprise of the average annual yields plus the random fluncuations occuring year after year. Estimates of the dependable yields at the various probability levels of occurrence have therefore to be worked out by taking into consideration the effects of the various cyclic components and the random part contained in the data of the annual yields.

The present method of estimation i.e., fitting a suitable frequency curve to the observed data of the annual yields and then estimating (by using it) the dependable yields at the various probability levels of occurrence, does not take into account the sequential effect due to the cyclic components contained in the data of the annual yields. Therefore, estimates of the dependable yields based upon the data for different sets of equal or unequal years are different and they differ in the maximum by 15 to 20% as indicated earlier. Extensive and intensive studies in this regard show that it is possible to estimate the dependable yields taking into account the effects due to both the random part and the cyclic components. For this purpose it is necessary to find out or to note:

1. how the sum total effect of all the cyclic components influences in the year to year yields,

2. what is the minimum number of years in sequence in which the sum total effect is maximum,

3. what are the compound probabilities resulting from the probabilities of obtaining the averages per year of the sum total effect of the cyclic functions for the above number of years and the probabilities of the various particular yields calculated from the data of the annual yields after the elimination of the cyclic functions,

4. what are the compound probability densities resulting from the probability densities of the above values of the cyclic functions and the values of the «y_r» resulting after the elimination of the cyclic functions.

5. the probability levels of occurrence of the dependable yields are equal to the above compound probability levels, and

6. Algebraic sum of the averages per year of the sum total effect of the cyclic components and the values of the yields estimated from the data resulting after the elimination of the cyclic functions, when they are weighted by the corresponding compound probability densities to know the average values of the dependable yields at the various probability levels of occurrence.

Another approach is also advocated for the estimation of the dependable yields from a data of annual yields resulting from the catchment of a project. It is generally observed that there are certain years in which yields received are so high or so low that can be expected to occur only once in 100 or 1000 years. The irrigation Engineer is never interested in the estimation of the dependable yields which fail to occur with a lesser probability than 1/6 or 1/8. Thus, it is of no interest to know what the actual yields are in very bad years so long they are much lower than the dependable yields having a probability level occurrence equal to 87½%. As the estimates of the dependable yields from the data containing a very high or very low yields are lower than those which result when they are omitted, whenever annual yields

ceived are very high or very low, such that they have only a probability of occurrence equal to ce in 20 or more years, they may be rejected from the data of annual yields and the rest the data may be utilised in the estimation of the dependable yields. However, cognisanse of e number of years of very low yields which are rejected from the given data of length equal the dominant periodicity or its multiple of the cyclic functions contained in it, should be ken while estimating the above dependable yields. Though this method uses the principle the statistical adjusment of the data more often than as usually accepted, yet as the probabi- y level of occurrence usually adopted in the theory of significance tests is very much higher an what is adopted in the estimation of the dependable yields, the above method of approach justifiable.

Estimates of the dependable yields based upon the above method vary with the year of mmencement owing to the effect of the random factor contained in the data of the annual lds. Therefore, all possible estimates of the dependable yields at the various probability vels of occurrence may be made from the data of length equal to dominant periodicity or multiple years and starting from different years and the average values of the dependable lds at the various probability levels of occurrence of the above possible estimates may be und out. This helps in knowing the optimum commencing year of the given data which gives e most efficient estimates of the dependable yields.

Estimates of the dependable yields based upon each of the above two methods are observed be very close to each other.

In the design of irrigation projects not only the amounts of annual dependable yields at rious probability levels of occurrence have to be considered, but also the distribution during e various periods of years should be taken into account. For this purpose the beginning of the ater Account Year for the catchment has to be known. Further, the relation between the lds received during the various periods of the year has to be ascertained. Also the average lds received during these periods have to be arrived at.

A study of the Serial Correlation Coefficients between the yields received from the catchment ring the various periods of the year are generally used for the evaluation of the first two. t as these Serial Correlations are quite in-adequate in-as-much as their values are governed the few very high or very low yields received during the above periods; ranks of the yields n be profitably utilised for the estimation of the inter-dependency of the yields received ring the various periods of the year. A generalised method of Paired Comparisons veloped in the Engineering Research Laboratories, Government of Andhra Pradesh, can used for the above purpose. The results obtained there-from are more helpful than the rial Correlation Coefficients.

Canonical correlations between the yields received during each of the earlier and the later riods of the year show definitely which of the yields received during the earlier months edominate in predicting the yields received during the later months.

Utilisation of the generalised method of Paired Comparisons and the Canonical Corre- ions, though they are new to the field of Hydrology, it may be observed that they are very lpful in knowing inter-relations between yields received during the earlier and the later riods.

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PRINTED IN BELGIUM

(T 502) Imprimerie Ceuterick, s.c., 153, rue de Bruxelles, Louvain
Dir. L. Pitsi, 25, rue Dagobert, Louvain (Belgique)

PRINTED IN BELGIUM